SCIENCE

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THE TRIPP ANTI-FRICTION ROLLER-BEARING.

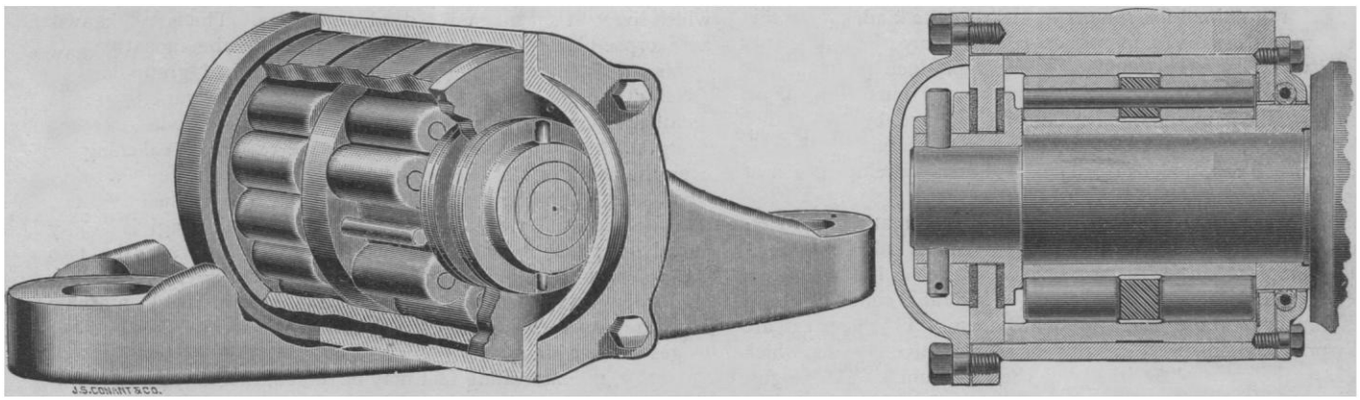
THIS bearing is adapted for use on car axles, dynamo-shafts, and similar places where there is high speed or heavy pressure, or both. It consists of a double set of rollers held in place by a sort of skeleton frame, and enclosed in a box of suitable construction. The rollers are of steel, of the same degree of hardness as when cut from the bar. They fit snugly around the shaft or axle, and bear against the inside of the box, revolving on their axes, and travelling around with the shaft, thus reducing the friction to almost zero, or, in other words, to rolling friction. Mr. J. A. Dyblie of the Chicago Arc Light and Power Company turned a six-inch shaft with his thumb and finger to and fro with the greatest ease.

The construction of the device may easily be understood by an inspection of the accompanying illustrations. Fig. 1 is a perspective view, with part of the outer shell or box broken away to show the interior, and one of the rollers removed to show the pin upon which it revolves. This pin, it must be remembered, performs no duty except to keep the roller in place when the shaft is removed, and to keep the roller in line with the shaft when in use. It bears no part of the weight of the shaft or axle, that all being transferred to the box by the rollers. Fig. 2 is a sectional view of the bearing, showing a very important feature; namely, the thrust-plate and collars, which take the end-thrust of the axle caused by the side-motion of the cars, as in going around a curve. This feature is shown at the left of the sectional view. The thrust-plate is bolted firmly to the box, and has two leatheroid collars — one on each side — between it and the thrust-collars, which latter are keyed to the end of the axle. This thrust-bearing has an area of sixty-three square inches, in contact at both ends of the car-axle, while that of the master car-builders' standard axle has an area of only seventeen square inches, in contact at only one end of the axle at a time.

It is stated, that, in a set of these bearings on a train running between Boston and Philadelphia, the rollers show a reduction in diameter of less than five one-thousandths of an inch, after a total service of forty-five thousand miles. They also remain uniform in size from end to end. This shows a very small amount of friction. Much of the long life of these rolls is doubtless due to the fact that the bearing is made dust-proof by a cap at one end and an expansive packing at the other, which, it is claimed, keep the lubricating material absolutely free from dust and water, so that it does not require renewal during the life of an ordinary chilled car-wheel.

Another advantage claimed is, that, when the brake is strongly applied, the strain comes on the rolls opposite the brake-shoe, causing no cramping, the axles turning as freely in the boxes as ever. In ordinary bearings the tendency is to crowd the journal out of the brasses, thereby reducing the bearing surface, inducing a tendency to heat when the journal returns to the centre of the box upon the release of the brake.

In a test of a two-inch journal in one of these bearings, under a pressure of four hundred pounds, without lubrication, it made a record of six thousand revolutions a minute for two hours without heating. Under a five-thousand-pound street-car, holding the regular number of passengers, a set of these bearings has been in use over two years with only one lubrication; and, though the car has been off the track the usual number of times, the bearings show no detrimental wear. They are now doing good service on about twenty street-cars, and are being applied to electric car-motors, stationary motors, shafting, and in various other places where a minimum of friction is desired.



ROLLER-BEARINGS FOR REDUCING FRICTION.

FUNGOUS DISEASES OF PLANTS.

VARIOUS rusts, smuts, mildews, blights, and similar diseases of cultivated plants, have been generally known and dreaded since plants began to be cultivated. Any understanding of the cause of these troubles, of the conditions of their occurrence, and of their relations to each other and to the plants they infest, is a matter of comparatively recent acquisition even among botanists. Among American farmers and gardeners it is only recently that intelligent inquiry and thought regarding these important sources of loss have been awakened, and they are but just beginning to be popularly spoken of as fungous diseases. With this increased popular interest has naturally arisen an increased interest in their scientific investigation, which is as yet but fairly begun, and in the practical application of our technical knowledge in devising ways and means for checking the spread and preventing the ravages of the pests.

In the October bulletin of the Hatch Experiment Station of the Massachusetts Agricultural College, Professor James Ellis Humphrey, professor of vegetable physiology, summarizes the results of his investigations on the subject. It is doubtless true that to the average reader the term "fungus" carries with it no definite idea. This is due partly to the newness of the popular use of the term and the meagreness of generally accessible sources of information concerning the fungi, and partly to the inherent difficulty and technicality of the subject. To obtain a clear notion of organisms so small as to be barely recognizable by the naked eye, and requiring high powers of the microscope for their study, yet with such apparently disproportionate capacities for mischief, is not easy. It is for this very reason all the more important, that, in a discussion of fungous diseases intended for popular information, an attempt should be made at the outset to remove, so far as may be, this fundamental difficulty.

In the first place, then, a fungus is a plant — as truly and essentially a plant as the corn-stalk or rose-bush on which it grows. Yet it is not only much smaller, but also much simpler, than these. While the plant-body of the corn or rose shows much specialization of structure, having the various vegetative functions of the plant performed by distinct organs (the root, stem, and leaves), very many plants show no such specialization, but have all their vegetative functions performed by the whole plant-body, which then needs no variety of organs. Of the latter class of plants are the rockweeds and sea-mosses, the fresh-water pond-scums and the fungi, which are obviously much simpler and more primitive plants than those with roots, stems, and leaves. In all true fungi the plant-body consists of numerous simple or branching white threads which spread over the surface or through the substance of the object on which the fungus grows. These threads constitute the so-called "mycelium" of the fungus, and are comparable with the more elaborate plant-body of other plants, since they perform all its vegetative functions.

Equally important with its own healthy growth is the provision by any plant or animal for the perpetuation of its kind, and to this end it develops organs of reproduction. In many of those plants provided with root, stem, and leaf, these reproductive organs are grouped into a structure called a flower; and such plants are known as "flowering plants." They all produce, by the further development of certain parts of their flowers, structures known as "seeds," which can, under favorable conditions, develop into new plants similar to that which produced them.

Fungi do not produce flowers, and they vary greatly in their reproduction; but they all agree in producing bodies called "spores," — much simpler than seeds, as would be expected, but analogous to seeds in their ability to develop, under favorable conditions, into plants similar to those which produced them. These spores are usually produced on special fruiting or reproductive threads, which grow from the vegetative threads of the mycelium of the fungus. The reproductive threads may remain separate, thus producing their spores free in the air; or they may become interlaced or consolidated into a complicated fruiting structure, on which the spores are produced either superficially or in cavities, from which they finally escape into the air. The spores of fungi, being so small and light, are readily taken up and widely spread by currents of air, and are easily carried by insects from plant to plant. In such ways a fungous disease may spread from a single insignificant case until it becomes epidemic over a large area.

In the course of its life-cycle, the ordinary flowering plant passes from the seed, through the seedling, to the adult plant, bearing flowers and then seeds like that from which it grew. Many of the fungi, however, pass through a much more complex life-cycle, during which a given fungus may produce several kinds of spores, and assume several forms so unlike each other that they can be recognized as different stages of the same plant only by careful, patient cultivation and study. It is convenient to select some one stage of such a variable fungus as its perfect or adult form, and it is natural and logical to regard as such that stage in which the fungus shows the greatest elaboration of structure, while the simpler stages through which it passes are commonly called "imperfect forms. This tendency of fungi to variety in form, or "pleomorphism," as it is called, greatly increases the difficulty of their study, and complicates those problems which concern the successful combating of fungous diseases.

A question which very naturally suggests itself is, "Why do fungi attack and cause diseases of other plants, instead of living independently?" This question involves matters of the greatest interest and of fundamental importance and significance. It is well known that all "green" plants owe their characteristic color to the presence of a definite pigment known as "leaf-green," or "chlorophyl," which is so generally present among the higher plants, that to most minds the very word "plant" carries with it the idea of greenness. Now, the possession of chlorophyl is the pre-eminent feature which gives to plants their all-important place in the economy of nature. No living thing can continue to live on inorganic substances, but all require as food some of those materials of comparatively complex chemical composition known as organic substances. The materials furnished by the earth, the air, and water are all of simple composition and unorganized; but in leaf-green we have the connecting link, the means of bridging the interval between the inorganic and the organic. Professor Humphrey does not discuss the process in detail. He thinks it sufficient for present purposes to say, that, in Nature's laboratory of the leaf, some of the simple constituents of air and water are combined, by the action of leaf-green in the sunlight, into the complex organic compounds which serve the plant as food. The chemistry of this remarkable process is not well understood, but the commonest permanent form in which these food-materials appear is that of starch.

Now, as was noticed above, the threads of the fungi are white, uncolored; that is, they contain no leaf-green: consequently the fungi cannot elaborate their own food-material, but must obtain it, ready elaborated, from some other source. Evidently the available sources of organic food-supply fall under two heads, — living organisms; and dead organic matter, commonly decaying. On this basis, the fungi may be divided into two classes, — those which derive their nourishment from other living things, and those which live on the remains of dead organisms. The latter, known as "corpse-plants" or "saprophytes," include the moulds, toadstools, and many other fungi; but the first-named group is that which at present is of interest, since it contains the various groups mentioned at the beginning, which live on or in the bodies of other living plants at their expense, and cause extreme weakening or even the death of the affected plants. Such fungi are known as "parasites," and the plants they attack are called their "hosts." This distinction between saprophytic and parasitic fungi is a very useful one; but no sharp line can be drawn between the two groups, since some fungi seem to be able to live either as parasites or as saprophytes, while it is probable that very many pleomorphic fungi are parasites in some of their forms, and saprophytes in other stages of their life-cycle.

Finally, the interesting fact may be noted, that any given parasitic fungus is usually restricted in its capacity for harm to a single host-plant or to a few closely related ones; though, on the other hand, closely related fungi may attack plants of widely different relationships. Thus, the mildew of the lettuce and that of the onion are very closely related fungi; yet neither mildew can attack the host-plant of the other, since the structural resemblances are few and the relationship remote between the lettuce and the onion.

From the above facts may be derived a few important principles for guidance in attempts to avoid or check the ravages of fungi among plants cultivated for use or beauty. Since the mycelium of a parasitic fungus grows usually within the tissues of its host-plant, it is too late to try remedies after a plant is once infected. It is true that a few fungi are superficial in growth, and a treatment may perhaps be found which shall destroy such parasites without harm to the host; but in most cases the aim must be to fortify exposed plants against infection by the timely application of protective solutions or mixtures, which shall prevent the germination of the spores which fall upon the plant so treated. Some progress has been made in this direction, and some results have been reached which justify hopes of ultimate general success in largely avoiding the present enormous annual losses resulting from fungous diseases.

The treatment which now gives promise of most general applicability and efficiency is the spraying of the plants with a solution of sulphate of copper (blue-stone) or with one of the preparations in which it is the important ingredient, known as "eau celeste," "Bordeaux mixture," etc. It seems very possible, too, that plants may be fortified against the attacks of parasitic fungi, or their susceptibility to such attacks be largely diminished, by special fertilization, for the purpose of introducing into the plant substances which, while not interfering with its growth, shall make it a less congenial soil for the growth of fungi. The line of investigation here suggested has not yet been followed out, although it offers an opportunity for chemico-physiological work which may yield important results. It is obvious, also, that a vigorously healthy plant will resist the fatal influence of parasites far better than a poorly nourished one.

Much may be done, after a plant is too far gone to be saved, to prevent further spread of the disease, by removing and destroying the diseased parts. It is not sufficient, however, to throw the portions removed into the rubbish-heap: the spores must be actually destroyed, and this can be effectually done only by burning. A considerable number of fungi produce, in the plants on which they live, resting-spores, which ordinarily remain on or near the ground in dead leaves or stubble, survive the winter, and, germinating in the spring, infect the new growth. In these cases the danger of a severe attack in the following year can be greatly lessened by clearing up and burning all such sources of infection.

Numerous instances can be cited of more or less common weeds or wild plants so closely related to certain cultivated plants that they are liable to the attacks of the same fungi, and so serve to perpetuate those fungi, and to infect the related cultivated plants when growing near. Evidently, then, such plants should be carefully and thoroughly exterminated wherever they may prove a source of danger.

Professor Humphrey then went on to speak of the application of the foregoing facts and principles in the consideration of a few particular fungous diseases.

W. T. DENNIS, commissioner of fisheries for Indiana, has issued a call for a State convention of the disciples of the rod and reel, and dog and gun, to meet at Indianapolis, Ind., on Thursday, Dec. 19, at noon.

A NEW RECORDING PRESSURE-GAUGE.[1]

IN designing the recording pressure-gauge herewith illustrated, the object was to produce an instrument which would be fundamentally simple, and consequently reliable, and which could be placed upon the market at a moderate cost.

Fig. 1 represents the instrument complete, and ready for application. Fig. 2 shows the pressure-tube with the inking-pointer attached; the front of the case, dial, and cover of clock, being removed. The pressure-tube *A* is of flattened cross-section, and bent into approximately a sinusoidal form. A flexible strip *B*, of the same metal as the tube, is secured at the ends and along the bends, as shown in Fig. 2. The bent tube may be considered as a series of Bourdon springs placed end to end.

Pressure applied to the tube produces a tendency to straighten each bend, or collectively to elongate the whole. This tendency to lengthen the tube is resisted by the flexible strip *B*, and thereby converted into a multiplied lateral motion. The inking-pointer is attached directly to the end of the pressure-tube, as shown in Fig. 2, from which it will be seen that the usual mechanism and multiplying-devices are dispensed with, since the motion of the tube itself is positive and of sufficient range. The special advantage of this is evident, considering that in all other pressure-gauges the movement of the tube or diaphragm is small, and requires a system of mechanism to multiply the motion many times before it is available for indicating purposes. These multiplying-devices must be delicately constructed and properly cared for, and even under the most favorable conditions they are liable at any moment to be a source of error.

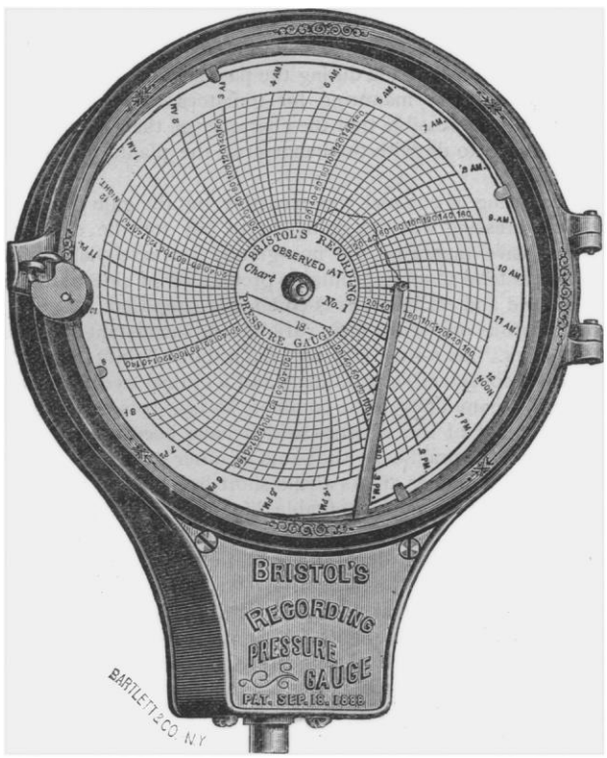


FIG. 1.

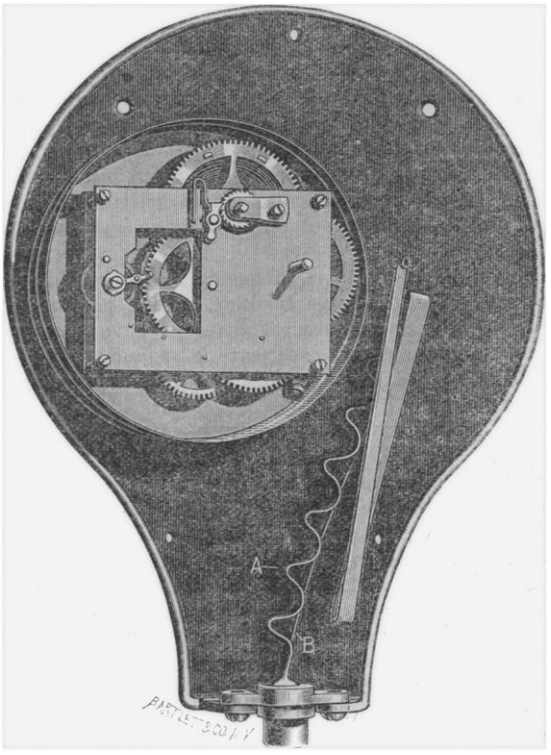


FIG. 2.

In the instrument illustrated the tube is designed for a range of one hundred and eighty pounds per square inch; for other ranges its sensitiveness may be varied at will by changing its proportions, as length, shape of cross-section, or thickness. The printed charts for receiving the record make one revolution in twenty-four hours, and are provided with radial arcs and concentric circles, the divisions on the radial arcs corresponding to differences in pressure; while those on the concentric circles correspond to the hours of the day and night.

During the past year and a half, several of the instruments have

[1] Paper read by W. H. Bristol of Hoboken, N.J., before the American Society of Mechanical Engineers, at its meeting, Nov. 21, 1889.

been in operation upon the steam-boilers at Stevens Institute, and have given perfectly satisfactory results.

In regard to making the tubes alike, it will be well to state that there has been no difficulty in producing a number in which the deflections were equal for equal pressures, and which have been directly applied to a standard chart, without adjustment. It will be readily seen, that, in case there should be slight differences in the deflections, such differences may be allowed for by raising or lowering the tube with reference to the dial. This is equivalent to shortening or lengthening the deflections along the radial arcs. For an indicating instrument, it is only necessary to provide a graduated arc for the end of the tube to move over.

It is evident that the instrument is adapted for a vacuum as well as for a pressure-gauge, and it naturally follows, that, if sufficiently sensitive, it will serve as a barometer, and measure changes of atmospheric pressure.

The model herewith exhibited for this purpose was made by electro-deposition of nickel upon a piece of solder of the proper form, the solder being afterward melted out in oil. The walls of this tube are $\frac{1}{500}$ of an inch thick. When this tube is exhausted of air and sealed, as shown, it gives a deflection of about three inches and a half for an external change of pressure of one atmosphere.

Another application of the pressure tube is in the recording thermometer. The tube may be filled with a very expansible liquid, such as alcohol, and sealed. Variations in temperature produce expansion of the enclosed liquid, which, in turn, gives deflections of the tube to correspond. These deflections may be used to record directly, without multiplying-devices, as shown in one of the models.

The tubes of the pressure-gauges to be inspected have been made by the writer at Stevens Institute, for the purpose of thoroughly testing the novel form. The results have been perfectly satisfactory, and our recent experience in manufacturing has demonstrated the possibility of duplicating the tubes in quantities for a standard chart.

NOTES OF TOMATOES.

PERHAPS the most frequent and noteworthy observation made upon the culture of the tomato during several years of experimentation with the plant at the Cornell Agricultural Station has been the great increase in vigor and productiveness which comes from careful handling and good tillage. It often appears as if this vigor is not only characteristic of the immediate generation, but that it is hereditary for a time to a profitable degree. "Handling" or transplanting of young plants, when frequently and properly done, is invaluable; and, so far as the plant is concerned, three or four transplantings are better than one. In the station work, in order to get the greatest results from tests, the plants are handled in pots, preferably rose-pots, and are transplanted several times. The handling is expeditious, and is not too expensive for the use of any one who grows tomatoes for home use. For market culture they find that two transplantings are usually profitable. Stocky plants, vigorous, and growing rapidly, are better than simply early plants, however; and frequency of transplanting must not be confounded with early sowing and consequent necessity for several shiftings. Tomato-plants — or any plants, in fact — should not be shifted for the simple purpose of preventing crowding or "drawing." Transplanting serves the purpose of maintaining a steady and symmetrical growth, and it should occur before the plant becomes checked from neglect. A good tomato-plant at the time of setting in the field, is one which is stocky enough to hold the weight of the earth and pot when a number of plants are grasped in the hand by their tops, and are carried along the rows. They require no staking when set. A tall and weak plant with a blossom on the top is not considered worth setting. It is a common mistake to set tomato-plants in the field too early. Cold nights, even though several degrees above frost, check the plants, sometimes seriously.

How early the plants should be started for profit is a question which demands attention. A few writers have maintained of late that nothing is gained in earliness and productiveness by early starting under glass. This is undoubtedly true if the early plants are not well grown, but the Cornell experience is quite to the contrary with stocky and vigorous plants. Whether this increase is worth what it costs, is a question which must be answered by every grower for himself.

In every instance the early-sown plants gave earlier fruits than the others; and in every case but one, in which the yields were practically the same, the total yield is much greater. The gain in earliness sometimes amounts to three or even four weeks. The disadvantage of very late planting (middle of May) is particularly pronounced in the results at Cornell, especially in point of productiveness. This productiveness, however, is really a measure of earliness, inasmuch as it simply records the weight of fruit which had ripened up to Oct. 10, when the tomato season was closed by frost. Could the season have been sufficiently extended, no doubt the ultimate productiveness of the varions plantings would have been the same.

It is a common notion that soils containing little or no manure are preferable to well-enriched soils for tomato-growing. It is supposed that rich soils tend to make vine at the expense of fruit, causing lateness of maturity and consequent lessening of yield; and the supposition is prevalent that rich soils tend to make fruits "rougher," or more irregular in shape. A careful test upon these points has been made during the past season at Cornell, with the result that heavy manuring for tomatoes may give decided benefits; yet it is possible that the character of the soil or season may have much to do with the behavior of the plants under these conditions.

The manuring of one plat was excessive, but the gain due to the very heavy dressing was not sufficient to pay for the extra cost. But if excessive manuring did not greatly increase yield, neither did it always tend to an unprofitable production of vine at the expense of yield and earliness, as is commonly supposed.

The tomato is one of the most variable and inconstant of kitchen-garden plants. As a rule, varieties differ but slightly from their allies, and a considerable plantation and a critical eye are needed to determine many of even the common sorts. It is certainly true that at least half of the varieties which have been offered in the last few years are practically the same as other varieties.

Varieties of tomatoes are as a rule short-lived. Ten years may be considered the average profitable life of a variety, and many sorts break up and disappear in two or three years. This inconstancy of type is largely due, no doubt, to the haste with which new sorts are put upon the market.

The demand in tomatoes now calls for fruits which are regular in shape, solid, large, and plants which are productive. The old angular sorts are rapidly disappearing in commercial practice. There has been no gain in earliness for the species for many years, if at all, and little if any need be expected. The cherry and plum sorts, with a few of the angular-fruited and wrinkled-leaved varieties, are still the earliest sorts. Yet comparative earliness between commercial varieties is an important consideration. There is also no gain in capability to resist rot: the cherry, plum, and angular sorts are still most exempt, the cherry and plum varieties entirely so.

An experiment was undertaken to determine if keeping qualities are correlated with solidity. Representative samples of many varieties, taken so far as possible in the same stage of maturity, were placed together upon a forcing-house table, and the fruits were removed as soon as they began to decay. It was found that some of the frailest varieties kept the longest. It appears, therefore, that solidity must be measured by a general judgment rather than by any definite expression. This conclusion is quite at variance with common opinion.

Much has been said concerning the superiority of certain varieties for cooking purposes, aside from quality of fruit. There is said to be characteristic differences between varieties in time of cooking and amount of shrinkage. A painstaking cooking test was made with a few varieties, but the results are so variable as to appear to be merely accidental or characteristic of individual fruits. The fruits were cut into thin slices and placed in boiling water. The shrinkages in weight and bulk do not appear to be correlated. In some instances shrinkage was slight, while in other varieties, equally as solid and good, it was great.

Four-fifths of the varieties of tomatoes now offered by dealers possess no points of superiority for general culture. It should be borne in mind that a variety which is simply good is not worth introducing. It must present some point of decided superiority over the best kinds at present known, in order to possess merit. This fact appears to be commonly overlooked in all classes of vegetables, and every year the grower is bewildered with the display of novelties.

HEALTH MATTERS.

IS MAN LEFT-LEGGED? — Dr. W. K. Sibley read a paper before the British Association in which he argued that man was naturally left-legged. Standing working with the right hand, there was a tendency to balance on the left leg. Race-paths were nearly always made for running in circles to the right, and the majority of movements (such as dancing, running, etc.) were more readily performed to the right. In walking it was natural to bear to the right: crowds as well as individuals did so. Troops started off with the left foot; the left foot was placed in the stirrup or step of the bicycle in mounting; the left foot was the one from which a man took off in jumping. The *Medical Record*, to which we are indebted for the above information, goes on to say, that, from measurements made by Dr. Garson of the skeletons of the two legs, in 54.3 per cent the left leg was the longer, and in 35.8 the right. From measurements of 200 pairs of feet, it was found that in 44 per cent the left, and in 21.5 the right, was longer, while in 34.5 they were equal.

THE STOMACH-BRUSH. — A dental journal publishes the following, translated from the German: In 1713 there was published a pamphlet entitled "A Complete Account of the most Useful Stomach Brush which is now to be had at the Brushmakers at the Old Court Sadler's Shop in Broad Street in Colln-on-the-Spree." Many a one may have wished to be able once in a while to have his stomach thoroughly cleaned out, and this speculative brush-maker gave a practicable means to give effect to this wish. In the pamphlet there is a drawing of the stomach-brush: it resembles a pipe-cleaner, but of course is larger. The stalk is made of four wires twisted together, covered with thread, silk, or small ribbons: it is twenty-six inches long. The brush at the under end is two inches long and one and a half broad, and is made of goat's-beard hair; but, when one has been accustomed to use it for three or four weeks, a horse-hair brush is substituted, this hair being somewhat stronger, and so the effect is better. The application of this most excellent brush is very simple. It is pressed through the throat down into the stomach, which, by drawing up and down of the brush, is cleaned. Thereafter cold water or brandy is to be drunk, and the operation is repeated till the cleaning is perfect. The cure is to be repeated every morning. The author says, according to the *British Medical Journal*, "At first you will find it rather troublesome to get the brush down, but when you put it in your mouth and on your palate, draw in breath and wind, and press it gently and gradually down, and, without any particular trouble, it will reach the stomach. After eight to fourteen days' practice, it will come as easily to you as eating or drinking." Of course, the daily application of the stomach-brush is the infallible remedy or preventive of all diseases that can be imagined. "Whoever uses this cure requires no other medicine, for it is good against all — cold, hot, and poisonous fevers, it gives a good appetite for eating, it is good against asthma, hemorrhage, headache, chest complaints, coughs, consumptions, apoplexy, toothache, sore eyes, dysentery, quinsy on the tongue, quinsy in the throat, ulcers, abscesses, cardialgy: it favors digestion, strengthens the heart, drives away pimples on the skin, is against choking in the stomach, etc., makes too fat and asthmatical and swollen-up people thin, and, on the other hand, makes meagre and thin people fat. The great effect, however, is produced only when the use of the brush is combined with that of an elixir. This is compounded of aloes, saffron, rhubarbona, lark-mushroom, wormseed, eugian, myrrh, theriac. After the stomach-washing, forty to fifty drops of the elixir is to be taken in wine, and this preserves for twenty-four hours against all poison and pestilence."

VACCINATION ON THE LEG. — A French practitioner, in the course of a large number of revaccinations, was struck with the fact that the operation was far more successful when performed on the leg than when the arm was selected. He has since availed himself of an opportunity of verifying his first impression; and last year, having to revaccinate 177 school-children, he chose the left leg in 99, and the left arm in 78, and carefully compared the results obtained, dividing them into three groups according as the eruption was typical, doubtful, or absent. Of the 99 cases vaccinated on the leg, as we learn from the *Medical Press and Circular*, 23 were typical, 31 doubtful, and 45 unsuccessful, being equivalent to a percentage of 23.2 and 31.3 respectively. Of the 78 children vaccinated on the arm, the numbers were 11 typical, 25 doubtful, and 42 failures, equal to 14.1 and 32 per cent respectively. The percentage of failures was 45.45 on the leg, as compared with 53.84 on the arm.

AFRICAN JUMPERS. — Dr. Bennett of Griqualand writes in the *South African Journal* an account of a peculiar nervous affection which is met with among the Griquas and other natives and individuals of mixed descent living in Griqualand. He suggests that perhaps the affection is similar to that prevalent among the French Canadians, and known there by the name of "jumpers." Dr. Bennett says, "The affection is entirely confined to the male sex, and I have never seen or heard of a case in the female. The victims of this strange form of neurosis go through the most extraordinary and grotesque antics on the slightest provocation. A whistle, a touch, a shout, — any thing, in fact, sudden and unexpected, — will 'set them going.' Some will stiffen their limbs, make hideous grimaces, and waltz about as if they had no joints in their body. Others will jump wildly about like dancing dervishes, imitating the particular sound that had acted as an exciting cause. Some, again, will make use of the most obscene expressions on a transient impulse, correcting themselves immediately afterward, and expressing their regret for having used such language; while others, on the spur of the moment, will do any thing they are told to do. If they should happen to have a piece of tobacco in their hand, and one should suddenly shout, 'Throw it away!' they will do so at once, running away for a short distance, and trembling all over their body. I remember one case in particular: it was that of a 'bastard' boy, a mason by trade. He had been handed a piece of tobacco, and the person who handed it to him shouted out suddenly, 'Throw it away: it is a snake!' He first danced about wildly for a short time, and then ran away as fast as he was able; but he had not gone far, when he fell down in a 'fit,' and it was some time before he recovered."

SMALL-POX. — Dr. Lewentaner of Constantinople, writing in the *Bulletin Général de Thérapeutique*, No. 32, 1889, speaks very encouragingly of the success attending an antiseptic method of treating this disease, which he tried in several cases. The advantages of this method of treatment are summed up by *The Medical Record* as follows: 1. All the children treated in this way recovered, although the ordinary mortality of the disease is forty per cent. 2. The duration of the disease was decidedly shortened, the period elapsing from the commencement of the eruption to the falling-off of the crusts being twelve or thirteen days. 3. The disease ran its entire course almost without fever. 4. The danger to those around the patient is greatly lessened. In Dr. Lewentaner's cases there were other children exposed, but, notwithstanding that they were not vaccinated, they did not contract the disease. 5. The simplicity of the method, as compared with the treatment by baths and cold applications, has much to recommend it. 6. Æsthetically, also, the antiseptic method of treatment offers great advantages, since it prevents absolutely all pitting.

HEREDITY OF ACQUIRED CHARACTERISTICS. — Professor William H. Brewer of Yale read a paper on the above subject at the recent meeting of the National Academy of Sciences in Philadelphia. He combats the view of Weissmann, who has published a volume in support of the proposition that characteristics acquired by individuals are not transmissible. Weissmann supports this proposition by experiments on mice, whose tails he cut off for successive generations, without inducing a tailless diathesis in their offspring. Brewer discussed four kinds of variation: 1. Variation

in size; 2. Variation caused by exercise, training, and education; 3. Variations due to disease; 4. Characters assumed as the result of accident or mutilation. It is well settled that abundance of food affects the development and size of the individual and of the offspring. All cattle-breeding proceeds on this postulate. A good example of the second class of variations is afforded by the evolution of the trotting horse, which began during the present century, and has proceeded so far as to produce a breed of horses which have actually lost the instinct to run, and trot even while they are young. Variations due to disease are equally powerful, but less susceptible of demonstration. An example is ringbone in horses, caused by accident to the individual, but transmitted to offspring. As regards heredity of mutilations, numerous instances are cited, among which were enumerated several cases of malformed fingers in offspring of parents whose fingers had been injured by accident. Conspicuous instances of sports developing into varieties are certain forms of merino-sheep, and sequoia-trees of a certain type of foliage. Professor Brooks, in discussing the paper, according to the abstract in *The Medical Record*, opposed Brewer's view, and said that adaptations of nature have been evolved for the good of the species, not for that of the individual: hence they are not ordinarily transmitted, and the inherited effect of the influence of environment bears no appreciable effect on the evolution of species. Thus the larva of worker and drone bees is protected by an envelope of silk all around, while that of the queen bee leaves the abdomen unprotected, for the obvious purpose of enabling the mature queen to sting her larval rival when the swarming season is over, thus sacrificing the individual for the good of the community. The generation of polymorphic hydroids is an instance where the functions of generation are not exercised by the working members of the group, so that instincts acquired by experience are not transmitted. The bodies of all animals are similar polymorphic aggregations of cells. The cells of the body which are exposed to external influences and vicissitudes are outside the line of succession in generation. Dr. H. C. Wood of Philadelphia also opposed Brewer's conclusions. He doubts whether there is such a thing as hereditary disease. It is not the disease, but the liability to disease, that is inherited; in other words, the lack of power of resistance to external irritation. Consumption, for instance, is caused by the presence of an organism, the bacillus. This bacillus is certainly not inherited. We all breathe it, but not all become consumptive. Persons who have not sufficient power of resistance are affected by disease. These persons have inherited a weak constitution, or their powers of resistance have been weakened. This is all the heredity there is about it.

NOTES AND NEWS.

THE recent great reduction in the price of aluminum, made possible by improved methods of production, will doubtless lead to its adoption, to the exclusion of other metals, in the manufacture of transits, compasses, field and opera glasses, hand-levels, etc. The fact that it takes a beautiful finish, has a low specific gravity, is easily worked, and is practically non-corrosive, makes it the ideal metal for such purposes.

— The properties of quicksand are thus described in the *Mechanical News*: "The difference between building-sand and true quicksand is most easily explained by comparing building-sand to road-metal, while the quicksand must be represented by fragments no larger than large buckshot, but shaped like very smooth potatoes. In a word, the quicksand is small and thoroughly water-worn, so that every fragment has been deprived of all its angles and fairly well polished. Its particles are very small as compared with those of the building-sand. The smaller the size and the more complete the rounding, the more nearly will the sand approach a liquid condition when it is moistened. The first glance at a fairly mounted sample of quicksand under a microscope is sufficient to show that the quickness of the sand is amply accounted for by the innumerable friction-wheels which the particles themselves furnish. Sharp or building sand, on the other hand, will show few round corners, many angles, corners, and a general condition like that of broken stone. Sea-sand is often unfit for building, even though perfectly deprived of its salt, the reason being that the particles have been worn and polished till they have no more binding-power than so many cobblestones. It is well to remember that quicksand when dry, if very fine, shows the same properties as a liquid. In holding up the centres of large bridges, it is sometimes put into cylinders with a plunger on top of it. It will, when thus confined, hold up the load like a column of water. When it is desired to strike the centres, a plug is drawn out of the side of the cylinders, and the sand flows out like so much water. The advantage, of course, is that the sand does not need a packed piston, and does not leak out, though the work be prolonged for years. Quicksand, when dry and confined, forms an admirable foundation, and when wet can be loaded over its whole surface, and give a good support if side openings can be avoided.

— According to the Paris correspondent of London *Industries*, the Maussier process of manufacturing aluminum is coming to the front, for it is announced that one of the largest engineering firms has undertaken to work it on an extensive scale. The process, he continues, comprises three distinct periods and kinds of operations, — the desilification, the reduction, and the liquation. The desilification is effected by means of fluorine or fluoride of calcium at a high temperature in the presence of carbon. Lime, or the carbonates of potassium or sodium, may be added to facilitate the decomposition of the silicate. The reduction or expulsion of the oxygen is obtained by means of iron and manganese raised to incandescence in the presence of carbon. The liquation, the object of which is to separate the aluminum from the iron and the manganese, is effected by dropping the molten mass into carbon ingot moulds. These moulds are made of wood-charcoal. The aluminum so obtained is nearly pure.

— To add to the many obligations under which he has laid Cambridge University, Professor Sidgwick has offered to give £1,500 towards the completion of the new buildings urgently required for physiology, on condition that the work is undertaken forthwith. The Financial Board has accordingly recommended a scheme by which this can be effected. *Nature* adds, "The alliance between mental science and physiology which this gift represents is a bright feature of Cambridge studies at present."

— A novel and interesting application of science to art may now be seen at the Arts Exhibition, London, where Mrs. Watts Hughes shows specimens of what she calls "voice figures." As described in *Nature*, these are practically Chladni's figures produced in a viscid medium. Semi-fluid paste is spread on an elastic membrane stretched over the mouth of a receiver. A single note "steadily and accurately sung" into the receiver throws the paste into waves and curves. The patterns formed are either photographed immediately after production, or are transferred as water-color impressions while the membrane is still vibrating. Fanciful names, e.g., "wave," "line," "flower," "tree," "fern," are given to these. The effect, especially in transparencies, is very beautiful. Some of the forms would repay the study of physicists as well as of artists. The most interesting are perhaps the "daisy forms," in which we are told that "the number of petals increases as the pitch of the note which produces them rises." The apparatus employed is not exhibited, and the descriptive label is not very clear, but we understand that Mrs. Hughes would be most pleased to explain the matter to any one scientifically intererested in it. Her address is 19 Barnsbury Park, N.

— The recently established Geological Survey of Arkansas, of which Dr. John C. Branner is director, has taken up its work with remarkable vigor and success. The first volume, containing the administrative report for 1888 and a report on the geology of western central Arkansas, was rapidly followed by the second, on the neozoic geology of south-western Arkansas, the body of which is the result of the joint work of the United States Geological Survey and of the Geological Survey of Arkansas. By this co-operation Professor Robert T. Hill was able to extend his studies on mesozoic geology over Arkansas, and the volume is chiefly taken up by his report. The third volume is a preliminary report upon a portion of the coal-regions of Arkansas, which will be followed by a fuller report later on, as topographical as well as geological work is still being carried on.

— The medals of the Royal Society have this year been awarded as follows: the Copley medal to the Rev. Dr. Salmon, F.R.S., for his various papers on subjects of pure mathematics, and for the valuable mathematical treatises of which he is the author; a royal medal to Dr. W. H. Gaskell, F.R.S., for his researches in cardiac physiology, and his important discoveries in the anatomy and physiology of the sympathetic nervous system; a royal medal to Professor Thorpe, F.F.S., for his researches on fluorine compounds, and his determination of the atomic weights of titanium and gold; and the Davy medal to Dr. W. H. Perkin, F.R.S., for his researches on magnetic rotation in relation to chemical constitution.

— The rapid decrease in the number of kangaroos is beginning to attract the attention of scientific societies in Australia. From the collective reports of the various stock-inspectors it was estimated that in 1887 there were 1,881,510 kangaroos. In 1888 the number fell to 1,170,380, a decrease of 711,130. The chief obstacle to the adoption of measures for the effectual protection of the kangaroo, says *Nature*, is his vigorous appetite. One full-grown kangaroo eats as much grass as six sheep; and graziers, who as a class are not, it is to be feared, readily accessible to the influence of sentiment, find that the food eaten by this interesting animal might be more profitably utilized otherwise. In a communication on the subject, lately submitted to the Linnean Society of New South Wales, Mr. Trebeck suggested that the National Park might be used for the preservation not only of kangaroos, but of very many members of the Australian fauna and flora.

— The following, from a circular in regard to a one-thousand-dollar prize manual, may interest some of our readers: "The American Secular Union, a voluntary association having for its object the complete separation of Church and State in practice as well as in profession, and in no way committed to any system of religious belief or disbelief, acting herein by its president, Richard B. Westbrook, A.M., LL.D., as its special trustee and attorney-in-fact, hereby offers a premium of one thousand dollars lawful money of the United States for the best essay, treatise, or manual adapted to aid and assist teachers in our free public schools and in the Girard College for orphans, and other public and charitable institutions professing to be unsectarian, to thoroughly instruct children and youth in the purest principles of morality without inculcating religious doctrines; thus recognizing the legal right under our Federal Constitution of all our citizens, Jews and Gentiles, Catholics and Protestants, Liberals and Agnostics, and all other classes, whether believers or disbelievers, to have their children instructed in all the branches of a common secular education in our State schools, without having their tender minds biased for or against any sect or party whatever. It is desired that the manual for which this premium is offered shall not be a reading-book for schools, nor a mere code of morals, much less a system of ethical philosophy, but rather a concise yet comprehensive and suggestive exhibit, with familiar and practical illustrations of those universal foundation principles and axiomatic truths which underlie all sound morality and rightfulness, thus developing and educating that inherent moral sense which is more or less common to all rational human beings. In short, to show how to teach children the natural and essential difference between right and wrong, and the reasons therefor, without reference to sacerdotal creeds and sectarian dogmas, is the chief object to be kept in mind in writing for this premium; as it is the unquestionable right of every tax-payer and citizen of this free Republic to have their children educated in our common schools without having their minds prejudiced on those disputed subjects which may safely be intrusted to the family, the churches, and the Sunday-schools, where they properly belong. While each writer will be expected to confine himself or herself to the main object of this offer, the widest practical freedom in the form and range of treatment will be allowed, but all prejudice and partisanship regarding current controversies should be scrupulously avoided. The manual should not contain less than 60,000 words, nor more than 100,000, though these limits will not be insisted upon in a work of special merit. The papers should all be submitted by April 1, 1890, though more time will be granted if necessary; but the committee will be ready to receive manuscripts by the first day of January, 1890. Each manuscript should be in typewriting, or at least should be very legibly written, to insure a careful reading, and should have a special mark or designation, and the name and post-office address of the author should be sent at the same time in a sealed envelope—not to be opened until after the award is made—bearing the same mark, and both addressed to R. B. Westbrook, No. 1707 Oxford Street, Philadelphia, Penn., post or express prepaid. Unaccepted manuscripts will be returned to the writers at their own expense, and the accepted manuscript shall become the exclusive property of the Union, to be held in trust by the trustee herein named; and the premium of one thousand dollars will be promptly paid, without discount, when the copyright is thus secured. The money is now on deposit, in trust, with the Guarantee Trust and Safe Deposit Company in Philadelphia, for the object contemplated. A representative and impartial committee shall in due time be carefully selected by the subscribers to this fund or a majority of them, to act as judges of the manuscripts submitted, and to award the prize. The trustee herein named shall be a member and the chairman of said committee, whether he continues in the presidency of the American Secular Union or not. Writers of all nations are invited to join in the friendly contest, and the award will be made without regard to nationality or sex."

— The National Educational Association and Council of Education have decided to hold their next annual conventions at St. Paul, Minn., July 4 to 11, 1890. Hon. James H. Canfield of Lawrence, Kan., is president of the association. It is expected that there will be twenty thousand teachers present from all points of the Union. The Western railroads have already agreed to give half rates, plus two dollars membership fee, to all persons who attend; and Eastern and Southern roads will make low rates, which will be announced at an early date. St. Paul has organized a local executive committee, and the most complete arrangements are being made to give the teachers a welcome to the North-west, and to make the meeting a great success. There will be ample hotel accommodation at reasonable rates. Local excursions are being planned to all important points of interest in the North-west and on the Pacific coast, which will furnish teachers with the finest summer holiday trips that they ever enjoyed. The official "Bulletin," containing programmes, rates, and full particulars, to be issued in March, will be sent free by addressing S. Sherin, secretary local executive committee, St. Paul, Minn.

— A remarkably interesting paper on the last living aboriginal of Tasmania was read by Mr. James Barnard at the meeting of the Tasmanian Royal Society about two months ago. It has hitherto been generally believed that the aboriginal Tasmanians are extinct. Mr. Barnard, however, as we learn from *Nature*, contends that there is still one survivor, — Fanny Cochrane Smith of Port Cygnet, the mother of six sons and five daughters, all of whom are living. She is now about fifty-five years of age. Fanny's claims to the honor of being a pure representative of the ancient race have been disputed, but Mr. Barnard makes out a good case in her favor. He himself remembers her as she was forty years ago, when there were still about thirty or forty natives at Oyster Cave; "and certainly at that time," he says, "I never heard a doubt expressed of her not being a true aboriginal."

— No question in the range of agricultural subjects discussed is awakening more interest among New York's 350,000 farmers than the subject of cattle-foods and their economical use in feeding rations for the production of milk, and its products butter and cheese. This being true, it is believed that the information derived from scientific investigation, along with the practical experience of New York cattle-feeders, will be welcomed by dairymen as one advance step towards successful dairying. New York State has one and a half million milch cows, probably producing, on an average, less than three thousand pounds of milk per year; and the average annual butter product per cow for the State is undoubtedly less than one hundred and thirty pounds. This should not be, when there are whole herds averaging three hundred and some four hundred pounds of butter per year for each cow. Animals producing these by no means phenomenal yields are not confined to any particular breed, and are often grades of our so-called native

or no-breed animals. Proper selection, systematic breeding, and judicious feeding have produced these profitable animals and herds. What has been accomplished by the few should be striven for by the many, and feed must be a prime factor in developing the ideal dairy animal or herd. Careful breeding and selection must hold the most prominent place; but breeding and selection, unless accompanied by good care and judicious feeding, will ultimately result in failure. In the October bulletin of the New York Agricultural Experiment Station, of which Peter Collier is director, are brought together tables, with proper explanations, showing the composition of cattle-foods, the digestibility of such foods, the amount digested from various foods in general use, and finally several feeding-rations are given, together with those rations fed by a few of the farmers in different parts of the State.

— According to the *Novoe Vremya*, the carrier-pigeon has been turned to a curious use in Russia. It is to convey negatives of photographs taken in a balloon. The first experiment was made from the cupola of the Cathedral of Isaac, and the subject photographed was the Winter Palace. "The plates were packed in envelopes inpenetrable to light, and then tied to the feet of the pigeon, who safely and quickly carried them to the station at Volkovo." So we are told; but there is an extensive hiatus in the account, as pointed out by the *British Journal of Photography*. The wonderful material on which the negatives were taken is not stated, nor the mode of preserving from light, nor how this is proposed to be arranged in a balloon, nor the distance of the bird's flight. This is all a very different affair from the Paris Pigeon Post, the messages in which were photographed by collodion on glass, which was afterwards peeled from its support, and enclosed in a packet attached to, not the bird's feet, but a tail-feather. Seeing that about fifteen grains is looked upon as a practical weight for a bird to carry, it would appear that very little negative and light-tight wrapping could be included in the weight, which does not include much in the shape, for example, of thin paper, seeing that even so slight an object as a five-pound (or any other) bank-note weighs more than that amount.

— As showing a good reason for the flocking of students from America and England to Germany, the following letter of Professor Silvanus P. Thompson to the London *Times* is in point: "Your Brussels correspondent, who attributes the attendance of English students at the technical high schools (or *polytechnicums*) in Germany, and particularly at that in Berlin, to the non-existence of such institutions in this country, must be ignorant of the fact that for five years a really splendid establishment of this character has been actively at work in London. I refer to the Central Institution, founded by the City and Guilds of London, in Exhibition Road. The equipment of this establishment for mechanical engineering and for electrical engineering far exceeds that of the Technical High School in Berlin, though in some other departments it is necessarily not equal. The cost of the Central Institution, which is the nearest approach in this country to a true polytechnic, was, however, only £90,000, while that at Berlin cost over £600,000. I may add that that other establishment of the City and Guilds of London Institute, the Finsbury Technical College, from which I write, and which has been open somewhat longer, cost about £35,000 only; but yet it can, in the departments mentioned, show educational results that will not compare unfavorably with those of the Berlin Technical High School. Yet the entire building at Finsbury could be contained within the entrance-hall of the palatial establishment at Berlin." In this same connection the remarks of the German correspondent of the *Daily Telegraph* are nteresting, as they give the number of foreign students enrolled on the books of the *Technische Hochschule*, or "Technical University," of Berlin. Since 1884 the palatial *Technische Hochschule* of Charlottenburg, near Berlin (called the *Berliner Technische Hochschule*), has certainly given instruction to an increasing number of foreign students, but the influx has not been so very extraordinary. Since the winter term of 1885, when there were only two British subjects on the books, the numbers have been, winter of 1886, four; summer of 1887, five; winter of 1887, eight; summer of 1888, ten; winter of 1888, eleven; summer of 1889, thirteen. Russia heads the list, having contributed, in 1881, thirteen pupils, and in the last term, forty-two. Norway comes next, with twenty-five last term. From North America there were seven. Then came Austria, South America, Servia, Switzerland, Sweden, Italy, Roumania, Spain, Holland, Luxembourg, and Greece. The number of foreign students amounted in the last term to 129, some 15 per cent of the total number on the books. This, compared with the thirty-three enrolled in 1881, shows a good increase. From the above official figures no deductions of importance can be drawn as to the estimation shown by British technical students for the very excellent *Technische Hochschule* of Berlin.

— It would seem as if the influence of bacteria and micro-organisms generally upon higher forms of life was only just beginning to be understood. The researches of naturalists are constantly bringing new and unexpected facts to light. For instance: there is nothing better known than the frequent phosphorescence exhibited by marine animals, and especially the crustacea. This phosphorescence is frequently infectious; that is to say, it can be communicated by touch. A French naturalist, M. Giard, has just made known the results of some observations and experiments he has been making with *Talitrus* and other crustacea. On microscopically examining a brightly phosphorescent specimen he found walking slowly on the beach instead of leaping, as its habit usually is, he traced the phosphorescent light to the presence of bacteria in its muscles, which were greatly altered. On inoculating other and healthy individuals of this and other species, the same disease was produced among them, and M. Giard says that his laboratory was quite lit up at night with these diseased but luminous crustacea. The inoculation was continued to the sixth generation, apparently without any attenuation of the microbic action. The disease seems to follow a regular course, and the crustaceans died in three or four days. The phosphorescence, however, always lingered a few hours after death. Crabs were inoculated in the same way.

— Dr. Noetling, of the Indian Geological Survey, to whose report on the petroleum deposits of Burmah reference has already been made, gives an interesting description of the native method of digging oil-wells. As soon as a native has made up his mind where he is going to have a new oil-well, as stated in the *London Times*, the workmen (usually four in number) begin to dig a square shaft, the sides of which measure between four feet and four feet six inches. Over this pit a cross-beam, supported on stanchions at either side, is placed, in the centre of which is a small wooden drum or cylinder, which, with its axis, is made of a single piece of wood, the latter running on coarse fork-shaped supports. The leather rope used in hauling up the oil passes over the drum, and on it is fastened the workman who is going to be lowered down, as well as the common earthenware pot in which the oil is drawn up. If possible, the well is so placed that the men or women drawing the rope walk down an inclined plane along the slope of a hill. The tools employed in digging are quite primitive, and can only be used in soft strata. Timber is used to support the walls of the shaft, and the latter is lined with wood. This wooden wall has considerable strength; but it has to be carefully watched, lest it should give way. The workmen are lowered in an ingenious way. The man sits on two slings formed of strong rope running between his legs and knotted over his left shoulder. To prevent sliding, a thin rope runs down from the knot, across the breast, underneath the right shoulder, to the back, where it is fastened to the rope forming the slings. A second rope for the same purpose is fastened round the hips. On account of the explosive gas filling the shaft, no light can be taken down: the workman, therefore, ties up his eyes previous to descending, so as to enable him to see during the short time he is in the well; otherwise it would take him longer to accustom his eyes to the darkness than he is able to stay down on account of the gas, which renders breathing difficult. The data obtained by Dr. Noetling as to the time occupied in the ascent and descent, and the period during which the laborer can remain below, show that not 25 per cent of the total working time is really spent in extracting the oil. Two hundred and ninety seconds is the longest time any man, however strong, can remain below without becoming unconscious, while in some he can only remain sixty seconds. With increasing depths the difficulties in obtaining the oil after the Burmese methods become insuperable:

hence the limit is 310 feet, and the workers object to more than 250 feet. The drawing-up of the oil is as primitive as every thing else. The rope is fastened round the neck of the ball-shaped pot, and, being lowered, is allowed to fill by sinking in the oil below. The oil thus raised is poured into another pot of the same shape, but much larger; and twelve of these are packed on each country cart.

— Among some mineral samples lately forwarded by Dr. Belgrade to the Mines Department for examination from a newly discovered lode in the Broken Hill district, New South Wales, were three in which the analyst, Mr. Minage, detected the presence of platinum. According to the *Engineering and Mining Journal*, sample No. 1, ochreous felspathic rock, yielded, on assay, platinum at the rate of 1 ounce 9 pennyweights 9 grains per ton; gold, a minute trace; no silver. No. 2, compact ferruginous claystone, yielded, platinum, 6 pennyweights 12 grains per ton; gold, a minute trace; no silver. No. 3, ferruginous felspathic rock with green carbonate of copper, yielded, platinum, a strong trace (under 5 pennyweights per ton); no gold or silver; a small quantity of platinum metals, iridosonine, iridium, etc. This discovery is of interest, as it is the first recorded instance of the occurrence in New South Wales of platinum *in situ* in a lode. Platinum has been found in alluvial deposits in the Bathurst, Clarence, and Richmond River districts, but not in paying quantity.

— Mr. Joseph C. Arthur, in a recent bulletin issued by the Agricultural Experiment Station of Indiana, summarizes as follows the results of some experiments on stinking smut (known as "bunt" in England): It is one of the most destructive diseases to which the wheat-crop is subject; not that it deteriorates the total product, but it causes a complete loss of a part, not infrequently of half or more, of the crop. It probably occurs to some extent throughout all wheat-growing regions, but most prominently in Indiana, Iowa, and adjacent States, as well as in California and Europe. It is caused by a fungus growing inside the wheat-plant. There are two species of this fungus, differing only in microscopic characters, — *Tilletia tritici*, with rough spores; and *Tilletia fœtens*, with smooth spores. The latter is most common in the Mississippi valley. Spores of the fungus, which are very nearly or quite in contact with the germ end of the wheat-grain, or touching the young plantlet between its attachment to the seed and the first joint, can grow into the tender tissues of the plant as the seed sprouts, and, drawing nourishment from the juices, develop along with the wheat, and finally produce spores in the kernels. A single spore may thus cause all the heads of a stool of wheat to smut. The disease does not spread from plant to plant or from field to field, but the infection always takes place at the time the seed sprouts. No remedy can be applied after the grain is sown, but the disease can be prevented by sowing clean seed in a clean soil, and covering well. If a farm is already infested, seed known to be pure can be obtained, or the smutty seed can be purified by thoroughly wetting with a solution of blue vitriol, using one pound or more to a gallon of water, and either sow damp or first dry with plaster or slacked lime. Take care that the thresher, storage bin, fanning mill, seeder, sacks, and every thing else coming in contact with grain to be used as seed, are thoroughly disinfected, if they have previously been used for smutty wheat. Do not follow smutted wheat with wheat again for one, or, better still, for two years, but with some other crop. Do not apply stable-manure or permit stock to run on land to be put into wheat, if smutty grain or straw has been used for feeding or bedding. Where there is danger of infection, do not sow wheat on wet or insufficiently drained land, and use a variety of wheat least affected by smut. The cost and trouble of ridding a farm of stinking smut, and keeping it free, are very slight compared to the loss which is likely to result from inattention. The statements just made regarding stinking smut apply equally well to black smut, with the following exceptions: black smut is more common everywhere than the other, and causes a loss greater than is usually supposed, but which rarely reaches the large percentages of stinking smut; it is caused by a fungus (*Ustilago segetum*) of similar habits to the other smut, but, unlike that, is not confined to wheat, but attacks other small grains as well; the means of clearing a farm of black smut are essentially the same as for the other, but with the differences that wheat, oats, rye, and barley are all susceptible to the disease, and cannot follow one another when clearing the soil of the spores; and that grain with hulls requires longer soaking with blue vitriol than hulless grain.

— In a recent letter to the company engaged in introducing the magnolia anti-friction metal, mentioned in these columns a few weeks ago, the chief engineer of the steamship "Owego" gives a very favorable report of its use on that vessel. The "Owego" is said to be the fastest vessel on the Great Lakes. She is 2,500 tons burden, and has triple-expansion engines of 3,000 horse-power, with cylinders 28, 42½, and 72 inches in diameter respectively, and 4½ feet stroke. Some time ago the metal used in the low-pressure crank-pin bearing, fourteen inches in diameter by sixteen inches long, heated till it melted and ran out. Magnolia-metal was substituted, since which time, the engineer states, "the chill has not been off the brasses, although we have encountered weather that would lift the propeller-wheel out of the water."

— The lecture committee of the Nineteenth Century Club reports that its programme this season has been arranged so as to give a greater preponderance to literature and art, in order to meet the criticism of last winter that the subjects were too much of a political and ethical character. It was not, however, originally intended that Miss Edwards's address should be on the "Art of the Novelist;" but this topic seemed preferable because her other addresses will be delivered in New York and Brooklyn before she will appear before the club. The following is the list of subjects and speakers as thus far arranged; subject, of course, to unforeseen changes. A star against a name indicates that the speaker is not yet positively engaged. Nov. 22, 1889, "The Pulpit and Politics," Rev. Henry Van Dyke, D.D. (Presbyterian): discussion by Mr. R. R. Bowker (Episcopalian), Rev. Amory H. Bradford, D.D. (Congregationalist), and Hon. Jno. A. Taylor (Unitarian). Dec. 13, "The Construction of a Play," Mr. Bronson Howard: discussion by A. M. Palmer, Mr. Dion Boucicault.* Jan. 10, 1890, "Russian Nihilists and Novelists," Professor H. H. Boyesen: discussion by Mr. Hamilton W. Mabie (associate editor of the *Christian Union*), and ————. Jan. 31, "The Political Relations of the United States and Canada," Professor Goldwin Smith (of Toronto): discussion not yet settled. Feb. 21, "The New Southern Literature," Mr. Thomas Nelson Page (of Virginia): discussion by Mr. Richard Watson Gilder and Mrs. Maud Howe Elliott. March 18, "The Art of the Novelist," Miss Amelia B. Edwards: discussion not yet settled. April 4, an address by Hon. Seth Low on some topic, probably educational, not yet determined upon. April 25, "The Eastern Question," Hon. Oscar S. Straus (ex-minister to Turkey): discussion by Mr. George Kennan. The following are proposed and held in reserve: "Folk Music," by Mr. Frank H. Potter; "Nationalism," by Hon. T. W. Higginson;* "Psychical Research," by Rev. Minot J. Savage, D.D.;* "The Roman Church and the Schools," by Hon. W. Bourke Cockram;* "English Socialism," Mr. Percival Chubb;* "The Organization of Charity;" "Dress Reform." Friday evenings have been taken this year instead of Wednesdays because last year many members of the club were unable to attend on the last-named day. On other days the assembly rooms are not to be had. Accordingly the house committee has engaged the rooms for the above dates; Miss Edwards's lecture, however, being on Tuesday, by the special favor of the manager of the Opera House. The following orders have been made with regard to the conversational meetings provided for by vote at the last business meeting of the club: 1st, That the four members' meetings to be held the coming winter at private houses be conducted informally and conversationally, as far as due regard to order will permit. 2d, That the president designate some member of the club to preside over and conduct each of these meetings. 3d, That the person so designated shall, at least ten days prior to the meeting over which he is to preside, select and give to the secretary the subject to be discussed, which must first be approved by the lecture committee of the club. The secretary shall thereupon give at least one week's notice to all the members, of the time and place of such meeting, together with the subject to be discussed. 4th, No vote shall be taken upon any subject of discussion at any of these meetings.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XIV. NEW YORK, NOVEMBER 29, 1889. No. 356

CONTENTS:

IN THIS NUMBER we print the extracts from recent letters of Stanley that have reached this country. They show, that after getting back to the shores of the Victoria Nyanza, after his long journey back to the Kongo, after his first meeting with Emin Pacha in the early part of 1888, he found that the Pacha's authority had been considerably impaired; in fact, that at one time he had actually been a prisoner in the hands of his own troops. But, in spite of this, Emin showed some signs of hesitation about leaving the Sudan, which resulted in considerable of a strain on Stanley's patience. The rebellion was checked by a southern movement of the Mahdist forces, and Emin was once more free. The country, however, was in so disorganized a state, that Stanley finally set a date on which he must start for the coast, and is now on his way, with Emin as a doubting and reluctant companion. Whether Emin's vast stores of ivory and valuable collections are being brought out to civilization seems doubtful; but it seems likely that this long-lost army of southern Egypt will soon be a thing of the past, and that the region will be given over to barbarism till stronger forces are brought to bear.

THE OPINION EXPRESSED by the eminent engineer Mr. Towne, quoted in another column, as to our ability to properly prepare for an international exposition in 1892, because of the limited time at our disposal, will not be shared by many who have given attention to the subject. Ample time is, of course, necessary; but one or two years' time, in the present highly developed state of the architectural and engineering arts, and in what may be termed "the art of promoting expositions," is ample for doing what could not be done in double that time when the exposition of 1876 was planned. The opinion of Mr. Towne is worthy of consideration, but we think it is also worthy of reconsideration.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE tenth annual meeting of the American Society of Mechanical Engineers was held in this city on Nov. 18, 19, 20, and 21. The meeting was opened by an enjoyable evening reception at the society's rooms, at 64 Madison Avenue, on Monday, the 18th; and the business sessions began on Tuesday at the rooms of the Academy of Medicine, 12 West 31st Street, about a hundred and thirty members being present. Mr. Henry R. Towne, the retiring president, delivered the opening address, which consisted mainly of an account of the recent engineers' excursion to Europe, with some remarks on the Paris Exposition and the projected world's fair in this city, followed by an account of the present condition of the society. He briefly compared the time which had been found necessary to prepare for the Paris Exposition with that now left in which to prepare for an exposition in this city in 1892, and expressed the opinion that at least a year's postponement would be found necessary, and perhaps two years, if the fair was to be at all adequate to the occasion. Four years and a half were given to preparations for the Paris Exposition, while we have but little more than half that time in which to get ready. He congratulated the society on its vigorous growth, from a membership of 189 at the end of the first year (1880), to 1,049 at present. Mr. Towne concluded his address by hoping that the many local societies of mechanical and civil engineers would in time be converted into chapters or sections of a national society, and that there would be some one organization soon formed to include the best portions of all the societies.

The address, which was well received and heartily applauded, was followed by the reading of reports of the various officers and committees, and the discussion and adoption of resolutions on securing legislation to provide a government bureau of record, "wherein may be entered respectably recognized and approved standards, for the promotion of uniformity in the products of the arts, in technical customs, and in nomenclature." Other resolutions concerning the management of the society were also adopted.

The reading and discussion of papers were then taken up. The first paper was on "Properties of the Vapor of Water," by V. Dwelshauvers-Dery, which was followed by a paper on the "Theory and Design of Chimneys," by Horace B. Gale; one on the "Philosophy of Multiple Cylinders or Compound Engines," by R. H. Thurston; "Flow of Steam through Orifices," and "Experimental Study of the Different Types of Calorimeter," by C. H. Peabody; "Cost of Lubricating Car Journals," by L. S. Randolph; "Steam-Pipes for Collieries," by E. F. C. Davis; "Rolling Steel Rails," by D. K. Nicholson; and "Methods of reducing the Fire Loss," by C. J. H. Woodbury. In the evening many of the members, accompanied by ladies, discussed a subscription dinner.

Wednesday was devoted by the members to their annual excursion, in the course of which they visited the government instruction and proving ground at Willet's Point, as well as other places of interest. At Willet's Point, sight-seeing commeneed by a visit to the torpedo laboratory. Every thing was investigated, and obliging officers were found ready to explain the workings of the intricate apparatus used in the experiments.

The instruments attracting the most attention from the visitors were a Thomson galvanometer, a galvanometer with a reading telescope, a Thomson electric-current balance, a Thomson multicellular electrostatic voltmeter, a British post-office standard galvanometer, and an English "shutter" apparatus for operating and exploding torpedoes from shore. The general use of electricity in all these systems interested the observers at once. If our naval officers wish to fire a mine, they employ the electric spark. If they desire to drive a fish torpedo, they transmit to a motor within it a current of electricity. In steering it so as to strike the object to be destroyed, they employ the same means. If they wish to find a torpedo of their own which was lost, or to discover one concealed by an enemy, they make use of inductive effects as illustrated in the telephone, and actually use the telephone, which informs them of their approach to any metallic mass; also when they set torpedoes in channels to be defended, or have arranged submerged mines, electricity enables them to determine whether they are in order for use, or when they have been injured by accident or decay.

The museum and batteries at the Point were then visited in turn, and thoroughly examined and even criticised; but the general impression was that the apparatus and museum were a fair exposition of the progress of the art of modern warfare in this country, and well adapted to the teaching of practical work in torpedo defences. The station at Willet's Point is almost an advanced engineers' school, where young engineers graduating from West Point are sent for a course of engineering instruction, particularly in relation to torpedo-work.

Before leaving the Point, three torpedoes were exploded about three hundred feet distant from the shore for the benefit of the excursionists. The first one, containing about fifty pounds of mortar-powder, shot a column of water about one hundred feet into the air; but the second, containing fifty pounds of dynamite, not only doubled the distance, but seemed to reach bottom, judging from the discoloration of the surrounding water. The third and last, containing one hundred and fifty pounds of mortar-powder, caused a terrific report, and the flame which showed above the surface seemed to indicate that the torpedo had not been submerged deep enough.

In the evening, after the return of the excursionists, a reception and collation were tendered the visiting members by the Engineers' Club.

At the Thursday session the following papers were read and discussed: "Indicator Rigging for Compound Engines," by Fred. W. Parsons; "A New Recording Pressure-Gauge," by W. H. Bristol; "General Solution of the Transmission of Force in a Steam-Engine," by D. S. Jacobus; "Street-Railway Car Gear for Modern Speeds," by S. J. MacFarren; "The Comparison of Indicators," by J. Burkitt Webb; "The Cards from the Pawtucket Pumping-Engine with and without Jacket," by James E. Denton; "How to use Steam Expansively in Direct-Acting Pumps," by J. F. Holloway; "Cost of Steam and Water Power," by C. T. Main; and "Graphical Analysis of Reciprocating Motions," by Oberlin Smith. After the reading of these papers, the following resolution was unanimously adopted: "*Resolved*, That the American Society of Mechanical Engineers cordially indorses and heartily urges the holding of the proposed great international exhibition in this country in the near future to celebrate the four hundredth anniversary of the discovery of America."

In the evening the society's guests and members visited the American Institute Fair by invitation.

On Friday the engineers visited Elizabethport, N.J., where they examined the works of the Singer Manufacturing Company and the Babcock and Wilcox boiler-works.

President Towne, in closing the session, made a proposition concerning the world's fair, to the effect that the society had approved of his statement that additional time was needed to make the fair a success, and that his proposition was to have a grand celebration and the unveiling of a monument of Columbus on the date of the four hundredth anniversary of the discovery of America, and then open the world's fair in May, 1893.

The officers elected for the ensuing year are as follows: president, Oberlin Smith of Bridgeton (N.J.); vice-presidents, Joel Sharp of Salem (O.), George W. Weeks of Clinton (Mass.), De-Volson Wood of Hoboken (N.J.); treasurer, William H. Wiley of New York; managers, J. E. Denton of Hoboken (N.J.), C. W. Nason of New York, H. H. Westinghouse of Pittsburgh (Penn.).

STANLEY AND EMIN.

MR. MARSTON of Sampson Low & Co., London, has received a letter from Henry M. Stanley, dated South End Victoria Nyanza, Sept. 3, from which the following extracts are taken: —

"The rebels of the Emin government relied upon their craft and on the wiles of the 'heathen Chinee,' and it is amusing now to look back and note how punishment has fallen on them. Was it Providence, or was it luck? Let those who love to analyze such matters reflect on it. Traitors without camp, and traitors within, were watched, and the most active conspirator was discovered, tried, and hanged.

"The traitors without fell foul of one another and ruined themselves. If it is not luck, then it is surely Providence in answer to good men's prayers.

"Far away, our own people, tempted by their extreme wretchedness and misery, sold our rifles and ammunition to our natural enemies, the Manyema, the slave-traders' true friends, without the least grace either of bodies or souls. What happy influence was it that restrained me from destroying all concerned in it? Each time I read the story of Nelson's and Parkes's sufferings I feel vexed at my forbearance, and yet again I feel thankful for a higher power than man's which severely afflicted them with cold-blooded murders by causing them to fall upon one another a few weeks after the rescue and relief of Nelson and Parkes.

"The memory of those days alternately hardens and unmans me. With the rescue of Emin Pacha, poor old Casati, and those who preferred Egypt's flesh-pots to the coarse plenty of the province near Nyanza, we returned; and while we were patiently waiting, the doom of the rebels was consummated. Since that time of anxiety and unhappy outlook I have been at the point of death from a dreadful illness. The strain had been too much; and for twenty-eight days I lay helpless, tended by the kind and skilful hands of Surgeon Parkes. Then little by little I gathered strength, and finally gave orders for the march for home.

"Discovery after discovery in this wonderful region was made, — the snowy ranges of Ruevenzeni, the Cloud King or Rain Creator, the Semliki River, the Albert Edward Nyanza, the plains of Noovgora, the salt lakes of Kative, the new peoples of the Wakonju or Great Mountains, the dwellers of the rich forest region, the Awamba, the fine-featured Wasonyora, the Wanyoro bandits, and then Lake Albert Edward, the tribes and shepherd races of the eastern uplands, then Wanyakori, besides the Wanyaruwamba and Wazinja, until at last we came to a church whose cross dominated a Christian settlement, and we knew we had reached the outskirts of blessed civilization."

Mr. Mackinnon, the chairman of the Emin relief committee, has also received a letter from Stanley. It is dated Aug. 5, and was written at Kafurro, an Arab settlement on the Karagwe. It begins, "My last report was sent off by Salim Ben Mohammed in the early part of September, 1888. Over a year full of stirring events has passed since then. I will endeavor to inform you what has occurred." Stanley goes on to recount the arrangements made by him to meet Emin, and, after describing how he hunted up the missing rear column, continues, —

"I have already told you that the rear column was in a deplorable state; that out of the one hundred and two members remaining I doubted whether fifty would live to reach the lake; but, having collected a large number of canoes, the goods and sick men were transported in these vessels in such a smooth and expeditious manner that there were remarkably few casualties in the remnant of the rear column. But wild natives, having repeatedly defeated the Ugarrowwas raiders, and by this means discovered the extent of their own strength, gave considerable trouble and inflicted considerable loss among our best men, who had always to bear the brunt of the fighting and the fatigue of paddling. However, we had no reason to be dissatisfied with the time we had made.

"When progress by river became too tedious and difficult, an order to cast off canoes was given. This was four days' journey above the Ugarrowwas station, or about three hundred miles above Banalaya. We decided, that, as the south bank of the Ituri River was pretty well known to us, it would be best to try the north bank, although we should have to traverse for some days the despoiled lands which had been a common centre for the Ugarrowwas and Kilongalangas bands of raiders. We were about one hundred miles from Grassland, which opened up a prospect of future feasts of beef, veal, and mutton, and a pleasing variety of vegetables, as well as oil and butter for cooking."

"On Oct. 30, having cast off the canoes, the land-march began in earnest, and we two days later discovered a large plantain plantation in charge of Dwaris. The people flung themselves on the plantains to make as large provision as possible for the dreaded wilderness ahead. The most enterprising always secured a fair share, and twelve hours later would be furnished with a week's provision of plantain flour. The feeble and indolent revelled for the time being on an abundance of roasted fruit, but always neglected providing for the future, and thus became victims to famine after moving from this place.

"Ten days passed before we reached another plantation, during which we lost more men than we had lost between Banalaya and Ugarrowwas. Small-pox broke out among the Manyema, and the mortality was terrible. Our Zanzibaris escaped the pest, however, owing to the vaccination they had undergone on board the 'Madura.' We were now about four days' march above the confluence of the Ihuru and the Ituri Rivers, and within about a mile from Ishuru. As there was no possibility of crossing this violent tributary of the Ituri or the Aruvimi, we had to follow its right bank till a crossing could be discovered. Four days later we stumbled across the principal village of the district, called Andikumu. It was surrounded by the finest plantation of bananas and plantains we had yet seen, which all the Manyemas' habit of spoliation and destruction had been unable to destroy. There our people, after severe starvation during fourteen days, gorged themselves to such excess that it contributed greatly to lessen our numbers. Every twentieth individual suffered from some complaint which entirely incapacitated him for duty.

"The Ihuru River was about four miles south-south-east from this place, flowing from east-north-east. It was about sixty yards broad and deep, owing to heavy rains. From Andikumu six days' march north-east brought us to another flourishing settlement, called Indeman, situated about four hours' march from a river supposed to be the Ihuru. Here I was considerably nonplussed by a grievous discrepancy between native accounts and my own observations. The natives called it the Ihuru River, and my instruments and chronometer made it very evident it could not be the Ihuru. We knew finally. After capturing some Daris, we discovered it was the right branch of the Ihuru, called the Dui River, this agreeing with my own view. We searched, and found a place where we could build a bridge across. Bonny and our Zanzibari chief threw themselves into the work, and in a few hours the Dui River was safely bridged. We passed from Indeman into a district entirely unvisited by Manyema."

Here the writer describes daily conflicts with the Wambutti dwarfs, which he found very numerous in this region. The Wambuttis clung to the north-east route, which Stanley wanted to take. Accordingly, he went south-east, and followed elephant-tracks. He says, "But on Dec. 9 we were compelled to halt for forage in the middle of a vast forest, at a spot indicated by my chart to be not more than two or three miles from Ituri River, which many of our people had seen while we resided at Fort Bodo. I sent one hundred and fifty rifles back to a settlement that was fifteen miles back on the route we had come, while many Manyema followers also undertook to follow them. I quote from my journal part of what I wrote on Dec. 14, the sixth day of the absence of the foragers:—

"'Six days have transpired since our foragers left us. For the first four days the time passed rapidly, I might say almost pleasantly, being occupied in recalculating my observations from Ugarrowwas to Lake Albert down to date, owing to a few discrepancies here and there, which my second and third visits and duplicate and triplicate observations enabled me to correct. My occupation then ended, I was left to wonder why the large band of foragers did not return. On the fifth day, having distributed all the stock of flour in camp, and having killed the only goat we possessed, I was compelled to open the officers' provision-boxes and take a pound pot of butter, with two cupfuls of my flour, to make an imitation gruel, there being nothing else save tea, coffee, sugar, and a pot of sago, in the boxes.

"'In the afternoon a boy died, and the condition of a majority of the rest was most disheartening. Some could not stand, falling down in the effort to do so. These constant sights acted on my nerves, until I began to feel not only moral but physical sympathy, as though the weakness was contagious. Before night a Mahdi carrier died. The last of our Somalis gave signs of collapse, and the few Sudanese with us were scarcely able to move. When the morning of the sixth day dawned, we made broth with the usual pot of butter, an abundance of water, a pot of condensed milk, and a cupful of flour, for one hundred and thirty people. The chiefs and Bonny were called to a council. At my suggesting a reverse to the foragers of such a nature as to exclude our men from returning with the news of the disaster, they were altogether unable to comprehend such a possibility. They believed it possible that these one hundred and fifty men were searching for food, without which they would not return. They were then asked to consider the supposition that they were five days searching for food, and then had lost the road perhaps, or, having no white leader, had scattered to loot goats, and had entirely forgotten their starving friends and brothers in the camp. What would be the state of the one hundred and thirty people five days hence?'

"Bonny offered to stay with ten men in the camp if I provided ten days' food for each person, while I would set out to search for the men. Food to make a light cupful of gruel for ten men for ten days was not difficult to procure, but the sick and feeble remaining must starve unless I met with good fortune; and accordingly a store of buttermilk, flour, and biscuits was prepared and handed over to the charge of Bonny. In the afternoon of the seventh day we mustered everybody, besides the garrison of the camp, ten men.

"Sadi, a Manyema chief, surrendered fourteen of his men to their doom; Kibbobora, another chief, abandoned his brother; and Fundi, another Manyema chief, left one of his wives and her little boy. We left twenty-six feeble and sick wretches, already past all hope unless food could be brought them within twenty-four hours. In a cheery tone, though my heart was never heavier, I told the forty-three hunger-bitten people that I was going back to hunt for the missing men. We travelled nine miles that afternoon, having passed several dead people on the road; and early on the eighth day of their absence from camp we met them, marching in an easy fashion; but when we were met the pace was altered, so that in twenty-six hours from leaving Starvation Camp we were back with a cheery abundance around us of gruel and porridge, boiling bananas, boiling plantains, roasting meat, and simmering soup. This had been my nearest approach to absolute starvation in all my African experience. Altogether, twenty-one persons succumbed in this dreadful camp.

"On Dec. 17 the Ihuru River was reached in three hours, and, having a presentiment that the garrison of Fort Bodo were still where I left them, the Ihuru was crossed the next day, and for the two following days we steered through the forest regardless of paths. We had the good fortune to strike the western angle of the Fort Bodo plantations on the 20th, and found that my presentiment was true. Lieut. Stairs and the garrison were still at Fort Bodo, fifty-one souls remaining out of fifty-nine.

"Not a word had been heard of Emin or of Jephson during the seven months of my absence. Knowing the latter to be an energetic man, we were left to conjecture what detained Jephson, even if the affairs of his province had detained Emin. On Dec. 23 the united expedition continued the march eastward; and as we had now to work by relays, owing to the fifty extra loads, we did not reach the Ituri Ferry, which was our last camp in the forest region before emerging on grass-land, until Jan. 9. My anxiety about Mr. Jephson and Emin would not permit me to dawdle on the road, making double trips in this manner: so, selecting a rich plantation and a good camping site east of the Ituri River, I left Stairs in command with one hundred and twenty-four people, including Parkes and Nelson, and on Jan. 11 continued my march eastward.

"The people of the plains, fearing a repetition of the fighting of December, 1887, flocked to the camp as we advanced, and formally tendered their submission, agreeing to the contributions and supplies. The blood of brotherhood was made, the exchange of gifts was made, and a firm friendship established. The huts of our camp were constructed by natives, and food, fuel, and water were brought to the expedition as soon as a halting-place was decided on. We heard no news of white men on Lake Albert from the plain people until on the 16th, at a place called Gaviras. Messengers from Kavalli came with a packet of letters, with one letter written on three dates, with several days' interval between, from Jephson, and two notes from Emin, confirming the news in Jephson's letter. You can but imagine the intense surprise I felt while reading the letters by giving you extracts from them in Jephson's own words:—

"'I am writing to tell you the position of affairs in this country, and I trust the letter will be delivered to you at Kavalli in time to warn you to be careful. On Aug. 18 a rebellion broke out here,

and the Pacha and I were made prisoners. The Pacha is a complete prisoner, but I am allowed to go about the station; but my movements are watched. The rebellion has been gotten up by some half-dozen Egyptians (officers and clerks); and gradually others joined, some through inclination, but most through fear. The soldiers, with the exception of those at Labore, have never taken part in it, but have quietly given in to their officers.'

"Jephson continued, 'When the Pacha and I were on our way to Regaf, two men — one an officer, Abdul Voal Effendi, and the other a clerk — went about and told the people they had seen you, and that you were only an adveturer, and had not come from Egypt; that the letters you brought from the Khedive and Nubar were forgeries; that it was untrue Khartum had fallen; and that the Pacha and you had made a plot to take them, their wives, and their children out of the country, and hand them over as slaves to the English. Such words, in an ignorant, fanatical country like this, acted like fire among the people, and the result was a general rebellion, and we were made prisoners. The rebels then collected the officers from the different stations, and held a large meeting here to determine what measures they should take; and all those who did not join the movement were so insulted and abused that they were obliged, for their own safety, to acquiesce in what was done.

"'The Pacha was deposed, and those officers suspected of being friendly to him were removed from their posts, and those friendly to the rebels were put in their place. It was decided to take the Pacha as a prisoner to Regaf, and some of the worst rebels were even in for putting him in irons; but the officers were afraid to put their plans into execution, as the soldiers said they never would permit any one to lay a hand on him. Plans were also made to entrap you when you returned, and strip you of all you had. Things were in this condition when we were startled by the news that the Mahdi's people had arrived at Lado with three steamers and nine sandals and nuggers, and had established themselves on the site of the old station. Omar Sali, their general, sent up three peacock dervishes with a letter to the Pacha, demanding the instant surrender of the country. The rebel officers seized them, and put them into prison, and decided on war. After a few days the Mahdists attacked and captured Regaf, killing five officers and numbers of soldiers, and taking many women and children prisoners; and all the stores and ammunition in the station were lost. The result of this was a general stampede of the people from the stations of Biddon, Kirri, and Muggi, who fled with their women and children to Labore, abandoning almost every thing. At Kirri the ammunition was abandoned, and was seized by natives. The Pacha reckons that the Mahdists number about one thousand five hundred. The officers and a large number of soldiers have returned to Muggi, and intend to make a stand against the Mahdists.

"'Our position here is extremely unpleasant, for since the rebellion all is chaos and confusion. There is no head, and half a dozen conflicting orders are given every day, and no one obeys. The rebel officers are wholly unable to control the soldiers. The Boris have joined the Mahdists. If they come down here with a rush, nothing can save us. The officers are all frightened at what has taken place, and are anxiously awaiting your arrival, and desire to leave the country with you; for they are now really persuaded that Khartum has fallen, and that you have come from the Khedive. We are like rats in a trap. They will neither let us act nor retire; and I fear, unless you come very soon, you will be too late, and our fate will be like that of the rest of the garrisons of the Sudan. Had this rebellion not happened, the Pacha could have kept the Mahdists in check some time, but now he is powerless to act.

"'I would suggest, on your arrival at Kavallis, that you write a letter in Arabic to Shukri Aga, chief of the Mswa Station, telling him of your arrival, and telling him that you wished to see the Pacha and myself. Write also to the Pacha or myself, telling us what number of men you have with you. It would, perhaps, be better to write me, as a letter to him might be confiscated. Neither the Pacha nor myself thinks there is the slightest danger now of any attempt to capture you, for the people are now fully persuaded that you are come from Egypt, and they look to you to get them out of their difficulties. Still it would be well for you to make your camp strong. If we are not able to get out of the country, please remember me to my friends,' etc.

"A postscript, dated Nov. 24, says, 'Shortly after I had written you, the soldiers were led by their officers to attempt to retake Regaf; but the Mahdists defended it, and killed six officers and a large number of soldiers. Among the officers killed were some of the Pacha's worst enemies. The soldiers in all the stations were so panic-stricken and angry at what happened, that they declared they would not attempt to fight unless the Pacha was set at liberty. So the rebel officers were obliged to free him, and sent him to Wadelai, where he is free to do as he pleases; but at present he has not resumed authority in the country. He is, I believe, by no means anxious to do so. We hope in a few days to be at Tunguru Station, on the lake, two days by steamer from Nsabe; and I trust when we hear of your arrival that the Pacha himself will be able to come down with me to see you. We hear that the Mahdists sent steamers down to Khartum for re-enforcements. If so, they cannot be up here for another six weeks. If they come up here with re-enforcements, it will be all up with us; for the soldiers will never stand against them, and it will be a mere walk-over. Every one is anxiously looking for your arrival, for the coming of the Mahdists has completely cowed them. We may just manage to get out if you do not come later than the end of December, but it is entirely impossible to foresee what will happen.'"

"Jephson, in a second postscript, dated Dec. 18, says, 'Mogo, the messenger, not having started, I send a second postscript. We were not at Tunguru on Nov. 25. The Mahdists surrounded Duffie Station, and besieged it for four days. The soldiers, of whom there were about five hundred, managed to repulse them, and they retired to Regaf, their headquarters. They have sent down to Khartum for re-enforcements, and doubtless will attack again when strengthened. In our flight from Wadelai the officers requested me to destroy our boats; and the advances, therefore, broke it up. Duffie is being renovated as fast as possible. The Pacha is unable to move hand or foot, as there is still a very strong party against him, and the officers are no longer in immediate fear of the Mahdists. Do not on any account come down to us at my former camp on the lake near Kavallis Island, but make your camp at Kavallis, on the plateau above. Send a letter directly you arrive there, and as soon as we hear of your arrival we will come to you. I will not disguise facts from you, that you will have a difficult and dangerous work before you in dealing with the Pacha's people. I trust you will arrive before the Mahdists are re-enforced, or your case will be desperate.'"

Stanley answered, "I have read your letter half a dozen times over, but fail to grasp the situation thoroughly, because in some important details one letter contradicts the other. In one you say the Pacha is a close prisoner, while you are allowed a certain amount of liberty; in the other you say you will come to me as soon as you hear of our arrival here, and 'I trust,' you say, 'that the Pacha will be able to accompany me.' Being prisoners, I fail to see how you could leave Tunguru at all. All this is not very clear to us, who are fresh from the bush. If the Pacha can come, send a courier, on your arrival at our old camp on the lake below here, to announce the fact, and I will send a strong detachment to escort him up to the plateau; even to carry him, if he needs it. I feel too exhausted, after my thirteen hundred miles of travel since I parted from you last May, to go down to the lake again. The Pacha must have some pity for me. Don't be alarmed or uneasy on our account. Nothing hostile can approach us within twelve miles without my knowing it. I am in the thickest of a friendly population; and if I sound a war-note, within four hours I can have two thousand warriors to assist me to repel any force disposed to violence; and if it is to be a war, why, then, I am ready for the cunningest Arab alive. I want to help the Pacha somehow, but he must also help me and credit me."

"On Jan. 16 I received with this batch of letters two notes from the Pacha himself, confirming the above, but not a word from either Jephson or the Pacha, indicating the Pacha's purpose. Did he still waver, or was he at last resolved? With any other man than the Pacha or Gordon, one would imagine, that being a prisoner, and a fierce enemy hourly expecting to give the *coup mortal*

he would gladly embrace the first chance to escape from the country. Given up by his government, there was no hint in these letters what course the Pacha would follow. These few hints of mine, however, will throw some light on my postscript, which here follows; and, in my state of mind after reading these letters, I wrote a formal letter which might be read by any person, — Pacha, Jephson, or any of the rebels, — and addressed it to Jephson, as requested; but on a separate sheet of paper I wrote a private postscript for Jephson's persual, as follows: —

Kavallis, January.

My Dear Jephson, — I now send thirty rifles and three Kavallis men down to the lake with my letters, with my urgent instructions that a canoe should be set off and the bearers be rewarded. I may be able to stay longer than six days here, perhaps ten days. I will do my best to prolong my stay until you arrive without rupturing the peace. Should we get out of this trouble, I am his most devoted servant and friend, but if he hesitates again, I shall be plunged in wonder and perplexity. I could save a dozen pachas if they were willing to be saved. I would go on my knees and implore the Pacha to be sensible of his own case. He is wise enough in all things else, even for his own interest. Be kind and good to him for his many virtues, but do not you be drawn into the fatal fascination the Sudan territory seems to have for all Europeans in late years. As they touch its ground, they seem to be drawn into a whirlpool, which sucks them in, and covers them with its waves. The only way to avoid it is to obey blindly, devotedly, and unquestioningly all orders from the outside.

The committee said, "Relieve Emin with this ammunition. If he wishes to come out, the ammunition will enable him to do so. If he elects to stay, it will be of service to him." The Khedive said the same thing, and added, that, if the Pacha and his officers wished to stay, they could do so on their own responsibility. Sir Evelyn Baring said the same thing in clear, decided words; and here I am, after 4,100 miles of travel, with the last instalment of relief. Let him who is authorized to take it, take it and come. I am ready to send him all my strength, and will assist him; but this time there must be no hesitation, but positive yea or nay, and home we go.

Yours sincerely,

Stanley.

In the course of his correspondence Mr. Stanley says, —

"On Feb. 6, Jephson arrived in the afternoon at our camp at Kavallis. I was startled to hear Jephson, in plain undoubting words, say, 'Sentiment is the Pacha's worst enemy. No one keeps Emin back but Emin himself.' This is the summary of what Jephson learned during the nine months from May 25, 1888, to Feb. 6, 1889. I gathered sufficient from Jephson's verbal report to conclude that during nine months neither the Pacha, Casati, nor any man in the province, had arrived nearer any other conclusion than what was told us ten months before. However, the diversion in our favor created by the Mahdists' invasion, and the dreadful slaughter they made of all they met, inspired us with hope that we could get a definite answer at last, though Jephson could only reply, 'I really can't tell you what the Pacha means to do. He says he wishes to go away, but will not move. No one will move. It is impossible to say what any man will do. Perhaps another advance by the Mahdists will send them all pellmell towards you, to be again irresolute and requiring several weeks' rest.'"

Stanley next describes how he had already sent orders to mass the whole of his forces ready for contingencies. He also speaks of the suggestions he made to Emin as to the best means of joining him, insisting upon something definite; otherwise it would be his (Stanley's) duty to destroy the ammunition, and march homeward. He continues, —

"On Feb. 13, a native courier appeared in camp with a letter from Emin, and with the news that he was actually at anchor just below our plateau camp. But this is his formal letter to me, dated the 13th: —

Sir, — In answer to your letter of the 7th instant, I have the honor to inform you that yesterday I arrived here with my two steamers, carrying a first lot of people desirous to leave this country under your escort. As soon as I have arranged for a cover for my people, the steamers have to start for Mswa Station to bring on another lot of people. Awaiting transport with me are some twelve officers anxious to see you, and only forty soldiers. They have come under my orders to request you to give them some time to bring their brothers from Wadelai, and I promised them to do my best to assist them. Things having to some extent now changed, you will be able to make them undergo whatever conditions you see fit to impose upon them. To arrange these, I shall start from here with officers for your camp, after having provided for the camp; and if you send carriers, I could avail myself of some of them. I hope sincerely that the great difficulties you had to undergo, and the great sacrifices made by your expedition on its way to assist us may be rewarded by full success in bringing out my people. The wave of insanity which overran the country has subsided, and of such people as are now coming with me we may be sure. Permit me to express once more my cordial thanks for whatever you have done for us,

Yours,

Emin.

BARNACLES.

Among the curious myths which in the middle ages did duty for natural science, one of the longest-lived, and yet one of the most extraordinary, was that which not only conceived the common shell-fish, the barnacle, to be the fruit of a tree, but went on to allege its transformation into the sea-bird known as the barnacle-goose. The successive changes from fruit to fish and from fish to fowl which the myth involved proved no obstacle to its wide acceptance and long-continued credence. According to an article by S. Heywood Seville, published in a recent number of *Knowledge*, it was widely current before the end of the twelfth century. Giraldus Cambrensis, writing in the reign of Henry II., gives, in his "Topographia Hiberniæ," a detailed account of it. "There are in this place," says he in one passage, "many birds which are called barnacles. Against nature, nature produces them in a most extraordinary way. They are produced from fir timber, tossed along the sea, and are at first like gum. Afterwards they hang down by their beaks as if from a seaweed attached to the timber, surrounded by shells in order to grow more freely. Having thus, in process of time, been clothed with a strong coat of feathers, they either fall into the water or fly freely away into the air. They derive their food and growth from the sap of the weed or the sea by a secret and most wonderful process of alimentation. I have frequently with my own eyes seen more than a thousand of these same bodies of birds hanging down on the seashore from one piece of timber, enclosed in shells and already formed. They do not breed and lay eggs like other birds, nor do they ever hatch any eggs, nor do they seem to build nests in any corner of the earth." After this account, Giraldus proceeds to inveigh against the custom, which prevailed in some parts of Ireland, of eating the barnacle-geese during Lent, — a custom which was justified by those who followed it by the argument that the geese were "not flesh, nor born of flesh," and which affords striking proof of the credence accorded to the story.

Though contradicted from time to time by some of the bolder writers and observers, the fable kept a strong hold on the popular mind, and even the educated were not ashamed to avow their belief in it. Sir John Maundevile alludes to it in his "Travels," where he speaks of the "trees that bear a fruit that becomes flying birds." Sir John somewhat naïvely adds, that the people "towards Upper India," to whom he recounted the story, "had thereof great marvel that some of them thought it was an impossibility." The "Travels" appeared about 1370, and more than two centuries later the subject was treated with considerable fulness, and in the most obvious good faith, by John Gerarde, who, in his "Herbal," published in 1597, devotes to it a chapter entitled "Of the Goose-tree, Barnakle-tree, or the tree bearing Geese," in which, after narrating the current belief as to the barnacle-geese being produced in the north of Scotland from shell-fish growing on trees, he proceeds to pledge his own credit as to the main facts of the story. Clearly, the myth was current in Shakspeare's time; and although, in an edition of the "Herbal" published in 1636, the editor added a note of caution to the reader at the foot of the chapter, yet eighty years after Gerarde wrote, a scientific writer was to be found, who, writing for scientific readers, asserted, of his own knowledge, the existence of the birds within the shells. This was Sir Robert Moray, who describes himself as "lately one of His Majesty's council for the Kingdom of Scotland," and who contributed to the "Philosophical Transactions" of 1677–78 a paper entitled "A Relation Concerning Barnacles," from which the following passages are transacted: "Being in the Island of East, I saw

lying upon the shore a cut of a large fir-tree, of about 2½ foot diameter and 9 or 10 foot long, which had lain so long out of the water that it was very dry; and most of the shells that had formerly covered it were worn or rubbed off. Only on the parts that lay next the ground there still hung multitudes of little shells, having within them little birds perfectly shaped. . . . The shells hang on the tree by a neck longer than the shell; of a kind of filmy substance, round and hollow, and creased, not unlike the windpipe of a chicken, spreading out broadest where it is fastened to the tree, from which it seems to draw and convey the matter which serves for the growth and vegetation of the shell, and the little bird within it. . . . This bird in every shell that I opened, as well the least as the biggest, I found so curiously and completely formed that there appeared nothing wanting as to the internal parts for making up a perfect sea-fowl; every little part appearing so distinctly that the whole looked like a large bird seen through a concave or diminishing glass, color and feature being everywhere so clear and neat. The little bill like that of a goose, the eyes marked, the head, neck, breast, wings, tail, and feet formed, the feathers everywhere perfectly shaped and blackish colored, and the feet like those of other water-fowl to my best remembrance."

Such was the old belief existing during five centuries, at any rate, and probably accepted at periods both earlier and later than those from which the preceding examples are taken. To modern observers it seems utterly absurd. Science has shown its absolute groundlessness as natural history; and Professor Max Müller, to complete the rout, has put forward, in his "Lectures on the Science of Language," a very interesting theory of its probable origin from the point of view of philology. But the latest researches have shown that the barnacle has been deposed from his place in a mythical metamorphosis, only to take part in his life-history as now ascertained in another transformation scene quite as wonderful, and this time vouched by the careful observations of our best naturalists.

In the adult state, Mr. Seville goes on to say, the barnacle consists of a shell-fish permanently attached, by a fleshy peduncle or stalk, to a piece of timber or rock or some other object in the sea. The shell opens by a peculiar valve-like arrangement, and, through the aperture thus formed, several pairs of long, many-jointed "cirri," or feelers, are put forth, which, by their constant waving motion, whirl to the creature's mouth the small particles which form its food. Huxley's description is concise and expressive: "A crustacean fixed by its head, and kicking the food into its mouth with its legs." It is not the change of this creature into a goose that science can now surprise us with: that story must be given up along with the accounts of griffins, phœnixes, and dragons. The fruit theory as to its origin must also be abandoned; but, though the new account does not involve quite so violent a transition as that from the vegetable to the animal kingdom, it is still in the steps by which the adult form is reached that those changes are revealed which almost entitle the barnacle to the reputation for facile metamorphosis with which our forefathers credited it. The steps in question are (besides the egg) the two stages known respectively as the *Nauplius* and *Cypris* stages. Immediately on its escape from the egg, the young barnacle appears as an animal of microscopic size, active and free-swimming, equipped with a broad shell or shield on its back, and having three pairs of legs, a single eye, a mouth, and a forked tail. This is the *Nauplius*, and in outward appearance the young creature exhibits at this stage no single point of resemblance to the parent form. It feeds and grows apace, and moults several times. It then enters the next condition of its existence, — the *Cypris* stage. The broad shield-shaped carapace becomes folded together, somewhat after the pattern of a bivalved shell, and almost encloses its owner. The foremost limbs are transformed into a very peculiar pair of suctorial or adherent feelers, and the two hinder pairs are cast off, their place being taken by six pairs of powerful swimming-legs with bifid extremities. A pair of compound eyes is another new feature of this stage; and altogether the *Cypris*, while still quite distinct from the adult barnacle, presents a very different appearance from the *Nauplius*. The mouth is wanting, or at least is functionless, being covered by an integument without aperture. Existence in this stage is therefore necessarily short, and the *Cypris* soon fixes upon its future abode by attaching itself by its suctorial feelers to some piece of drift-wood, pile, or rock. A kind of cement, which it secretes by means of special glands, pours out round the base of attachment, and quickly hardens, gluing the ends of the feelers firmly to the surface on which they rest. The compound eyes are shortly afterwards moulted, the body straightens out, and the shell thus comes to stand almost perpendicularly to the surface of attachment. Other changes follow: the shape of the shell is modified, and the position of the animal within alters in such a manner that the under surface of its body is turned directly away from the point of attachment; the integument covering the mouth is cast off; the legs cease all swimming ambulatory functions, and soon become mere cirri, sweeping the water for prey; the feelers are gradually covered with a fleshy pulp, and, losing all trace of their old form, are converted into a single stalk of attachment; the new parts of the shell which are to form the valvular opening, and other protecting plates, begin to form, and, for all practical purposes, the barnacle, though still very minute, has attained its adult form, future development being mainly in the matter of size.

The old legend involved a double change from fruit to fish, and from fish to bird; the new history also deals with a double change, from *Nauplius* to *Cypris*, and from *Cypris* to barnacle. For one series of wonders another has been substituted, and, if this is not sufficient to restrain us from too hastily condemning our forefathers' credulity, it will be well to remember how recently we have arrived at the truth. Little more than fifty years ago the position of the barnacle in the animal kingdom was still completely unsettled. Agreeing in most of its outward characteristics with the *Mollusca*, it was commonly classed with them. The *Nauplius* and *Cypris* were not connected with the parent form, but, if described at all, were treated as distinct animals. In 1830 J. Vaughan Thompson's description of his observations of their metamorphoses cast a new light on the subject; but the question still remained somewhat open ground for naturalists, and it was not until 1851–53 that Darwin, in his "Monograph of the Cirripedia," definitely settled the barnacle's claim to be classed with the *Crustacea*, and established beyond dispute the facts of its complicated and peculiar life-history.

BOOK-REVIEWS.

The Development of the Philosophy of the Steam-Engine. By ROBERT H. THURSTON. New York, Wiley. 16°. 75 cents.

THIS historical sketch, which relates not only to the steam-engine, but also to the various heat-engines embodying the same principles, was originally prepared by Professor Thurston some five or six years ago, and was presented in the form of a paper to the British Association for the Advancement of Science in 1884, at its Montreal meeting. The paper was favorably received, and was incorporated in full in the association's "Transactions" of that year. Believing the time appropriate for the publication of such a sketch, he now gives it to the public in a more permanent and accessible form. Though the author does not hold that the theory of the steam-engine is yet in its final perfect and complete form, he believes that the main principles and essential facts of a complete theory are well determined and well recognized by advanced thinkers and intelligent practitioners. This view of the case, we think, will not be disputed; and all persons concerned in engine-designing will find this sketch of the development of the philosophy of the steam-engine a valuable guide in working out future improvements.

Oceania: Linguistic and Anthropological. By Rev. D. MACDONALD. Melbourne, M. L. Hutchinson; London, Sampson Low. 16°.

THE author takes the stand that the ancient Oceanic mother-tongue was a branch of the Semitic family, and that while, like the other languages of this stock, it had much in common with all the rest of phonetics, grammar, and vocabulary, it had certain peculiarities, and that therefore the modern Oceanic dialects are Neo-Semitic, "somewhat as Modern Syriac." The author compares Malagassy, Malay, Efatese, and Samoan with many Semitic dialects, and calls his new family Semitic-Oceanic. The author can hardly claim to have succeeded in proving such a relationship.

The Bermuda Islands. By ANGELO HEILPRIN. Philadelphia, The Author. 8°.

PROFESSOR ANGELO HEILPRIN, in the summer of 1888, made an excursion to the Bermuda Islands, in order to study certain points in the structure and physiognomy of coral reefs, for the study of which the Bermudas offer special advantages. The present volume is the result of his observations on this journey. His observations regarding the formation of the island are fully in accord with those of Darwin, but, as the author points out, do not prove the correctness of the Darwinian hypothesis. Elevations and subsidences are both shown to have marked the region in its development. The author devotes an elaborate chapter of his book to a discussion of the various theories of formation of coral reefs, and expresses himself rather in favor of the old theory of Darwin. Where the author's results regarding the theory of formation of coral reefs are mainly of a negative character, his zoögeographical

results are of great interest. He finds that the Bermudian fauna is essentially a wind-drift and current-drift fauna, whose elements have been received in principal part from the United States and the West Indies. Some portion of the fauna appears to have been derived from the west coast of Europe and Africa, or from the Azores. The fauna appears to be of considerable antiquity, — a conclusion which is supported by the fact that the predecessor of a group of *Pulmonata* now peculiar to the islands is found fossil or sub-fossil in the rocks of these islands. Certain marked elements of the Bermudian fauna are of a distinctively Pacific type, but it seems impossible at the present time to explain this mixed relationship. The book is illustrated with good views from the Bermudas, and a number of plates illustrating the concluding chapters on zoölogy.

AMONG THE PUBLISHERS.

THE second part of the "Contributions to the Micro-Palæontology of the Cambro-Silurian Rocks of Canada," published by the Canadian Geological and Natural History Survey, is by Mr. E. O. Ulrich of the Geological Survey of Illinois. It consists of a descriptive report on some fossil *Polyzoa* (*Bryozoa*) and *Ostracoda* from Manitoba, and is illustrated by two full-page lithographic plates. To facilitate the binding of the present part with Mr. Foord's previously published report, the pagination and numbering of the plates of both have been made consecutive.

— A new guide-book to Florida, by Charles Ledyard Norton, will be published by Longmans, Green, & Co. early in December. The scheme of the volume is similar to that of the well-known Baedecker guides, adapted to requirements of travellers in such a country as Florida. Separate maps of the counties with post-roads and the new railway systems are a noteworthy feature of the book. This guide-book is a revival, on a new and more comprehensive plan, of "The Florida Annual" originally published, and most favorably received by the public, in 1885.

— The "Handbook of Precious Stones," by M. D. Rothschild, just published by G. P. Putnam's Sons of this city, is intended for the merchant, workman, and amateur. Mr. Rothschild is a well-known diamond-dealer of this city; and he was led to write this book by finding how many of those having to do with diamonds, rubies, sapphires, and emeralds, know nothing of these precious stones. The information is given in concise form, we fear even too concisely; but we trust that Mr. Rothschild's ambition may be gratified, and that a second and larger edition may appear in due time.

— Mr. Edwin Lassetter Bynner opens the December number of the *Atlantic Monthly* with an article of interest to the antiquarian, and especially to the student of Old Boston. This paper is devoted to "The Old Bunch of Grapes" Tavern, one of the most famous New England hostelries of the last century, and Mr. Bynner gives an amusing account of the various events which took place within its hospitable walls. Mr. Henry Van Brunt's paper on "Architecture in the West" tells about the difficulties which Western architects have to struggle against, and the new school of architecture which is gradually arising to solve the problem of making art keep step with progress without losing the finer and more delicate artistic sense. It will be studied by all Western men and all architects with a great deal of interest. Professor N. S. Shaler of Harvard College contributes a paper on "School Vacations;" and Mr. William Cranston Lawton, whose articles on the Greek drama have been among the best literary papers the *Atlantic* has lately had, writes about "Delphi: The Locality and its Legends;" and "Latin and Saxon America" (the relations of this country with South American countries) forms the subject of a paper by Mr. Albert G. Browne.

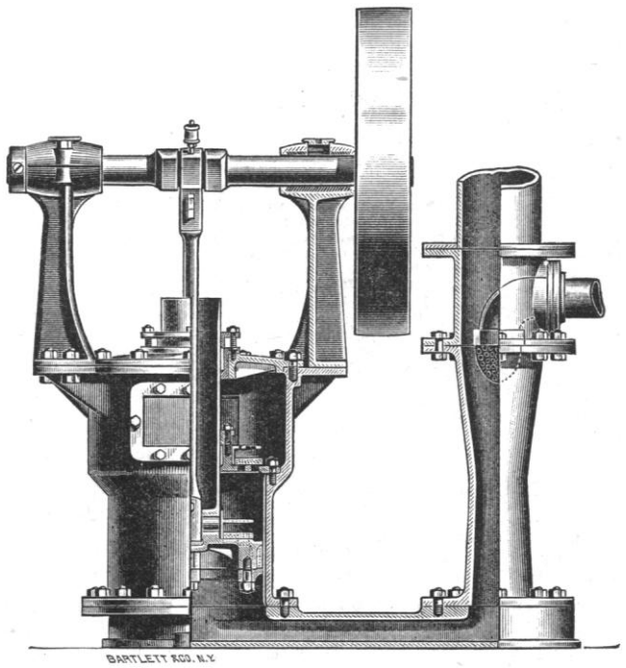
INDUSTRIAL NOTES.

Improved Belt Power Air-Pump and Condenser.

THE air-pump and condenser here illustrated has been newly designed by the builders, Conover & Co., 219 Market Street, Newark, N.J., in answer to the demands of power-users who are seeking the greatest attainable economy in all details of the modern steam-plant.

With the introduction of high-speed compound engines there is felt the need of a thoroughly efficient and simple condensing apparatus. The power required to drive it must be reduced to a minimum, and this same power must be of the most economical sort; otherwise the advantages gained by condensing will be seriously affected, if not wholly counteracted. In fact, it is a matter of record where tests have proven that certain engines have shown better economy running non-condensing than when condensing, owing to the very wasteful manner in which the power was applied to the condensing apparatus.

In presenting this air-pump and condenser to the public, the builders believe that they are offering a highly efficient, simple, and durable arrangement. As will be seen by the engraving, the air-pump is run by belt, which can be direct from the engine-shaft or from a counter-shaft, whichever may be the more convenient. Being driven by the main engine, it is obvious that the power used to operate the air-pump must of necessity be of the same economy as the engine. Thus, if the engine in question be compound condensing, running on two pounds of coal per horse-power or less, it necessarily follows that the air-pump will be operated by a similar economy. An examination of the engraving will make the operation of the condenser and air-pump quite plain. The



POWER AIR-PUMP AND CONDENSER.

spray distributes the injection water in such a manner that every particle of steam must come in contact with the water, and thus effect condensation with a minimum amount of water, and at the same time heat the overflow to the maximum temperature. The opening from the condenser to the air-pump is shaped to allow the greatest quantity of water to flow through a given opening. The pump is made amply large to remove the greatest quantity of water needed for condensing to the full capacity of the condenser. The reciprocating parts are counterbalanced by means of a weight in the wheel, to insure smooth running. As will be seen, the air-pump is vertical and single-acting; and this the builders believe to be the best form to avoid air-locks. In fact, the design throughout looks to the avoidance of all corners or pockets where air can collect and remain. This condenser is specially adapted to the requirements of high-speed compound engines in electric light and power plants, because it can be run at a speed independent of that of the engine, or it may be attached to more than one engine. It is also adapted to be applied to existing plants as a saver of fuel or an increaser of power on the same fuel. The machine is made throughout of the best of the several materials. All wearing parts and valve-seats that come in contact with injection water are made of best composition, and the workmanship is of the best. When the air-pump is in operation, the valves and stuffing-box are constantly covered with water, effectually sealing them. All parts are easily accessible without dismounting wheel or shaft.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Morris's "British Butterflies," Morris's "Nests and Eggs of British Birds," Bree's "Birds of Europe" (all colored plates), and other natural history, in exchange for Shakesperiana; either books, pamphlets, engravings, or cuttings. — J. D. Barnett, Box 735, Stratford, Canada.

I have *Anodonta opalina* (Weatherby), and many other species of shells from the noted Koshkonong Lake and vicinity, also from Western New York, and fossils from the Marcellus shale of New York, which I would be glad to exchange for specimens of scientific value of any kind. I would also like to correspond with persons interested in the collection, sale, or exchange of Indian relics.— D. E. Willard, Albion Academy, Albion, Wis.

Will exchange "Princeton Review" for 1883, Hugh Miller's works on geology and other scientific works, for back numbers of "The Auk," "American Naturalist," or other scientific periodicals or books. Write. — J. M. Keck, Chardon, Ohio.

"I wish to exchange *Lepidoptera* with parties in the eastern and southern states. I will send western species for those found in other localities."—P. C. Truman, Volga, Brookings Co., Dakota.

Shells and curiosities for marine shells, curiosities or minerals address W. F. Lerch, No. 308 East Fourth St., Davenport, Iowa.

A collection of fifty unclassified shells for the best offer in bird skins; also skins of California birds for those of birds of other localities. Address Th. E. Slevin, 2413 Sacramento St., San Francisco, Cal.

I have forty varieties of birds' eggs, side blown, first class, in sets, with full data, which I will exchange for books, scientific journals, shells, and curios. Write me, stating what you have to offer. — Dr. W. S. STRODE, Bernadotte, Fulton County, Ill.

I want to correspond and exchange with a collector of beetles in Texas or Florida. — Wm. D. Richardson, P.O. Box 223, Fredericksburg, Virginia.

100 botanical specimens and analyses for exchange. Send list of those desired and those which can be furnished, and receive a similar list in return. Also cabinet specimens and curiosities for the same. Scientific correspondence solicited. — E. E. BOGUE, Orwell, Ashta. County, O.

I will sell to chapters or individual members of the Agassiz Association, 25 fine specimens of fossil plants from the Dakota group (cretaceous), correctly named, for $2.50. Send post-office order to Charles H. Sternberg (author "Young Fossil-Hunters"), 1033 Kentucky Street, Lawrence, Kan.

Any one who has a botanical box in good condition wil please write. I will offer about 30 specimens in exchange. — C. B. Haskell, Box 826, Kennebunk, Me.

Lead, zinc, mundic, and calcite. — Lulu Hay, secretary Chapter 350, Carthage, Mo.

Drawings from nature — animals, birds, insects, and plants — to exchange for insects for cabinet; or I will send them in sets of ten each for ten cents in stamps. My drawings in botany are in detail, showing plant, leaves, flowers, seed, stamens, pistils, etc. — Alda M. Sharp, Gladbrook, Io.

A few first-class mounted birds, for first-class birds' eggs of any kind in sets. — J. P. Babbitt, secretary Chapter 755, 10 Hodges Avenue, Taunton, Mass.

California onyx, for minerals and coins not in my collection. — W. C. Thompson, 612 East 141st Street, New York, N.Y.

One mounted single achromatic photographic lens for making 4 × 5 pictures, in excellent condition; also one "new model" double dry-plate holder (4" × 5"), for fine geological or mineralogical specimens, properly classified. — Charles E. Frick, 1019 West Lehigh Avenue, Philadelphia, Penn.

The undersigned wishes to make arrangements for the exchange of *Lepidoptera* of eastern Pennsylvania for those from other localities. All my specimens are named and in good condition. — Charles S. Westcott, 613 North 17th Street, Philadelphia, Penn.

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

Nov. 19. — J. Owen Dorsey, Some Omaha Religious Practices; W. H. Holmes, Ancient Chipped Stone Workshops on Piney Branch, D.C.

Connecticut Academy of Arts and Sciences, New Haven.

Nov. 20.—Professor Brewer, The Progress of the Topographical Survey of Connecticut; Professor Verrill, A Remarkable Illusion Apropos of Haunted Houses.